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## *Original Communications*

# THE ROLE OF BACILLUS ACIDOPHILUS IN DENTAL CARIES*

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THE reports of recent investigations on the bacteriology of dental caries have centered the interest of students of this subject in the microbic factors concerned in the process and have revived the hope that a specific organism of caries may be discovered. Our present-day conception of dental caries is not materially changed from the views of W. D. Miller, who, in 1882, described the initial process as a decalcification of the enamel by acids produced in the fermentation of carbohydrates contiguous to the surface of the tooth. Miller, at that time, studied the organisms that were actively engaged in the acid fermentation, and stated that no one organism predominates but that he had isolated at least ten different organisms capable of producing acid fermentation of carbohydrates which, if localized on a surface of a tooth, might inaugurate enamel caries. He believed, therefore, that a certain group of organisms, namely the acid formers, and not a specific species, is responsible for caries.

In the years that have followed, many have studied the bacteria of caries and, by the application of newer methods of study, have greatly clarified our knowledge of dental bacteriology; but, as yet, no one has definitely established the specificity of any one organism for caries of the teeth. In 1903, Goadby[1] de-

*A report of the work done in the University of Michigan with the assistance of a grant from the American Dental Association.

1. Goadby, K.: The Mycology of the Mouth, London, 1903.

scribed two types of organisms as being active in caries, namely the fermenters and the liquefiers. He isolated from the deeper layers of carious dentin an acid-producing organism, which he named *B. necrodentalis,* and which he believed played an important rôle in the decalcification of the enamel and dentin. From later studies, it appears that this organism is in all probability identical with *B. acidophilus.* Somewhat later, Goadby[2] changed his views, stating his belief that certain streptococci are the active cause of dental caries, an opinion in which he was supported by Kantorwicz[3] and Baumgartner.[4] In 1917, Hartzell and Henrici,[5] in their studies on *S. viridans,* stated that this organism is uniformly present in all cases of dental caries, and claimed for it a leading rôle in the process.

In 1915, Kligler[6] published the results of an extensive study of oral bacteria in which he opposed the theory that streptococci are the active causative factors in caries, on the grounds that this type of organism is less prevalent in carious mouths and that it is not commonly found in decayed teeth. In his study of the organisms most commonly associated with initial caries, he found that they were limited to three, or possibly four types: (1) *B. acidophilus.* (2) *L. buccalis,* (3) *C. placoides* and, perhaps, (4) *B. putrificus.* This view was further substantiated by Howe and Hatch,[7] who found that the predominant organisms of caries were those of the Moro-Tissier group; namely, *B. acidophilus, B. bifidus* and certain divergent types, which they named *Bacillus X, M* and *Y.*

More recently, there have appeared almost simultaneously the reports of McIntosh, James and Lazarus-Barlow of England[8] and of Rodriguez[9] of the Army and Navy Medical School, all of whom have studied the bacteriology of caries by quite similar methods and have arrived at almost identical conclusions. In both instances, acid culture mediums were employed by which it was possible to separate from the varied mouth flora those organisms that are capable of forming and of withstanding relatively high degrees of acidity. Both reports stated that *B. acidophilus* predominated over all other forms of oral bacteria that were cultivable in acid mediums and that this organism was present in some form in every case of caries. Moreover, by immersing teeth in cultures of *B. acidophilus* taken from carious cavities, caries-like lesions were formed in the teeth.

Because of the great interest that has been aroused in *B. acidophilus* as a causative factor in dental caries and the apparent significance of the data thus far reported, we were led to direct our studies on the nature and causes of dental caries toward the bacteriologic factors concerned in the process, with special reference to *B. acidophilus.* If, as has been believed, the initial stage of dental caries is an acid decalcification, and if one or more types of acid-forming or-

2. Goadby, K.: Brit. M. J., 2: 769, 1910.

3. Kantorwicz: Ergeb. d. ges. Zahnheilk., 3: 49, 1912.

4. Baumgartner: Wein. klin. Wchnschr., 26: 178, 1913.

5. Hartzell, T. B. and Henrici, A. T.: Pathogenicity of Mouth Streptococci and Their Rôle in the Etiology of Dental Disease, J.N.D.A., 4: 477 (May) 1917.

6. Kligler: J. Allied Dent. Soc., 10: 141, 282, 445, 1915.

7. Howe, P. R., and Hatch, Ruth E.: Study of Micro-Organisms of Dental Caries, Dent. Cosmos, 59: 961 (Oct.) 1917.

8. McIntosh, James; James, W. W., and Lazarus-Barlow, P.: Etiology of Dental Caries, etc., Brit. Dent. J., 43: 728 (Aug. 1) 1922; Brit. J. Exper. Path., 5: 175 (June) 1924.

9. Rodriguez: Mil. Dent. J., 5: 199, 1922.

ganisms are invariably found to be present at the site of such decalcifications, it would appear that the process is essentially infective in character and that these organisms may be looked on as specific for the disease. Those who have previously studied this question have confined their attention largely to the bacterial flora of deep caries and more advanced stages of the process. Since, in the prevention of dental caries, we are most interested in the initial causative factors of that process, we have limited our studies to the initial stages of caries and the bacteria found to be associated with the first lesions on the tooth. The scope of our studies of the year may be grouped under the following heads:

1. The frequency of occurrence of *B. acidophilus* in carious and noncarious mouths.
2. The production of artificial caries.
3. The study of the morphology of *B. acidophilus*.
4. The study of the biochemical reactions of *B. acidophilus*.
5. An attempt to control caries by the inhibition of the growth of *B. acidophilus* in the oral flora.

## I. THE FREQUENCY OF OCCURRENCE OF B. ACIDOPHILUS IN CARIOUS AND NONCARIOUS MOUTHS

Goadby,[1] in 1903, observed a bacillus in the deeper layers of carious dentin, to which he ascribed a prominent rôle in dental caries. This organism, which he called *B. necrodentalis*, is morphologically similar to *B. acidophilus*, and in all probability is identical with that organism. Kligler,[6] in 1915, isolated *B. acidophilus* from carious teeth and studied sixty different strains. Howe and Hatch,[7] in 1917, found that at least one member of the Moro-Tissier group is always present in open cavities. McIntosh, James and Lazarus-Barlow,[10] in 1922, distinguished two types of acidophilus, of which they found Type I in the saliva of 30 per cent of cases and Type II in 20 per cent of all carious mouths. In 1924, in a study of eight cases, they[11] isolated their Type I from the saliva of every mouth. Part of these were carious and part were noncarious at the time the test was made. Rodriguez,[9] in 1922, also isolated *B. acidophilus* from the deeper layers of all carious dentin.

Our study of this question was directed toward (1) the frequency of occurrence of *B. acidophilus* in initial caries on portions of the tooth where the early stages of the process are clearly discernible, such as on the buccal and cervical areas, and (2) the occurrence of *B. acidophilus* in similar positions on teeth in mouths that are not subject to caries.

Considerable confusion may arise in such studies from the difficulty of determining the degree of susceptibility of certain mouths to dental caries at any given time. It is possible that there may be a large number of open cavities in the teeth, but, at the time of observation, the original causative factors may have disappeared, and, if the cavities are filled, the progress of the disease may spontaneously cease. Instances of this frequently occur at the age of early maturity. On the other hand, a mouth may never have had a carious lesion and may apparently be free from defect; but, at the time of observation, unseen forces conducive to dental caries may be operative and carious disintegration of the tooth may be under way. The evaluation, therefore, of the condition presented by a carious and a noncarious mouth is oftentimes not an easy matter, and errors in such diagnosis may lead the observer to faulty conclusions. In this study, we have spoken of as carious, only those cases that present distinctly whitened areas of enamel of apparently recent origin; and, as noncarious, only those cases in which there never has been

10. Footnote, 8, first reference.

11. Footnote 8, second reference.

a carious defect, nor any change in the condition of the patient that might be expected to alter the tendency toward dental caries.

The methods of our study were as follows: Scrapings were taken from whitened areas showing initial caries and, in cases of noncarious mouths, from regions of the teeth most difficult to keep clean. These scrapings were inoculated in 1 per cent glucose infusion broth, *p*H 5.0 and *p*H 3.8. They were shaken well to break up the material and were incubated at 37 C. Growths usually appeared within forty-eight hours; when the cultures were examined microscopically and plated on glucose-serum infusion agar or glucose-whey agar, reaction unadjusted (*p*H 6.2 to 6.6). These were incubated until colonies appeared, usually two or three days, at which time the various types of colonies were examined microscopically. Typical acidophilus colonies containing acidophilus-like organisms were transplanted into glucose broth, reaction unadjusted, and the acid production was then tested at intervals. If it gave a *p*H less than 4.4 in at least a week and showed gram-positive rods it was regarded as *B. acidophilus.*

Direct microscopic examinations were also made of the soft, accumulated *materia alba* in cases of very rapid cervical caries. This material scraped from a tooth was spread out on a slide in a drop of distilled water and the clumps broken up as much as possible to obtain a thin film. Gram, gentian violet and fuchsin stains were used.

The results of the foregoing tests were as follows: In mediums of *p*H 3.8, the broth nearly always remained sterile, as the acid seemed to be too concentrated to permit growth of any organism. The use of this method was discontinued very early. Inoculations into *p*H 5 broth on the other hand, very often gave pure cultures of *B. acidophilus,* as determined by plating. In other cases, the growth also contained streptococci or oidium-like organisms, which were able to withstand this degree of acidity.

In thirty-eight cultures taken from beginning cervical caries, *B. acidophilus* was obtained and isolated in every case (100 per cent positive).

In sixteen cultures taken from advanced, deep caries, *B. acidophilus* was obtained in fifteen cases (94 per cent positive). The one case giving a negative culture was the slow-growing cervical type, in which it was possible that the caries proper had spontaneously ceased. In cases in which there were beginning and deep cavities in the same mouth, positive acidophilus cultures were always obtained from both types of caries.

In nineteen cases in which there was a complete history of freedom from dental caries, three gave positive cultures of *B. acidophilus* (16 per cent positive). However, one examination only was made for each patient in the case of those giving negative cultures. It was interesting to note that one of the three positive cases always gave a prolific culture of *B. acidophilus,* even when inoculations were made from the saliva, the throat or the gums.

An oidium-like organism was isolated from twenty-two of forty-six carious mouths (48 per cent positive). This organism is frequently associated with *B. acidophilus* in dental caries, and it is possible that there is a symbiotic relationship between these organisms, which may play a part in the extreme overgrowth of *B. acidophilus.* From an experiment which will be related in Section II, we are convinced that this organism is not of importance directly in the decalcification of the teeth.

The direct smear method was found to be quite unsatisfactory as a routine procedure for examining the flora of carious teeth, on account of the great variety of organisms that usually were found in such specimens. In a few

cases, it was interesting to note that almost pure masses of *B. acidophilus,* recognizable by the morphology and the typical palisade arrangement, were observed. In one case (Fig. 1), practically nothing else could be recognized on the slide. In other instances, large masses of *B. acidophilus* were found in close proximity to mixed masses of threads, cocci, fusiform bacilli and other common mouth organisms (Fig. 2).

Fig. 1.—Direct smear, showing pure masses of B. acidophilus; fuchsin stain; × 1,500.

Figure 2.—Direct smear, B. acidophilus, Strain 49; gram stain; × 1,500.

Although smears from many noncarious mouths gave cultures devoid of *B. acidophilus,* direct smears from the same mouth would often show a few small clumps of that organism; but in no case were the large pure masses of bacillary overgrowth found, similar to those which prevailed in rapid caries.

*Summary.*—In the cases examined, we found *B. acidophilus* in every early lesion of dental caries, usually growing in high degrees of concentration. The fact that this organism is also present in mouths that are not subject to caries and in the mouths of animals suggests the possibility that, by diligent search, it may be found that *B. acidophilus* is an inhabitant of practically all mouths, but that great differences exist in the type of its growth and activity in various individuals. The methods of cultivation utilized revealed only the presence or absence of acid-forming organisms capable of cultivation on acid mediums, and gave no information concerning the number of such organisms in the mouth from which the culture was taken, or their ability to form overgrowths on particular areas on the teeth. Direct smears from certain cases of active caries showed almost pure masses of *B. acidophilus;* while similar smears from teeth in noncarious mouths contained these organisms, intermingling with other mouth organisms and showing little tendency toward typical clumping or mass development. It would appear, then, that, if this organism plays an important rôle in the process of tooth caries, its activity is determined not so much by its presence in the mouth as by the environmental conditions that determine the degree of its proliferation and localization in contact with tooth tissue.

A striking illustration of this fact was seen in the case of a young woman under our observation who for several weeks drank a quart of acidophilus milk daily. The strain of *B. acidophilus* used was one that had been isolated from a case of dental caries in this laboratory. Although the milk contained a rich culture of *B. acidophilus,* it was only with considerable difficulty that a few of these organisms could be recovered one week after the milk treatment was discontinued, and no considerable masses or overgrowths could be found. Manifestly, in this mouth, which at that time was not prone to dental caries, the oral environment was not favorable to the growth of *B. acidophilus.*

Fig. 3.—Tooth covered with shellac.

II. THE PRODUCTION OF ARTIFICIAL CARIES

*Production by Lactic Acid.*—In the attempt to produce artificial caries, we first subjected a series of teeth to varying strengths of lactic acid, noting the degree of acid required to decalcify the enamel.

Magitot,[12] in 1871, made extensive experiments to determine the action of various acids and salts on the enamel of the teeth. These experiments have been repeated in various forms by many workers since that time. Mummery,[13] in 1909, obtained decalcification of the enamel by 0.075 per cent lactic acid, and observed that various enamels showed marked differences in solubility. McIntosh, James and Lazarus-Barlow,[10] in 1922, observed the action of acid broths of *p*H 1.0 to 5.0 for thirty-four weeks on teeth immersed in them. They stated that, in broths with a *p*H at or higher than 4.0, no change in the appearance of the tooth could be observed. There was, however, a marked whitening of the teeth in broth at *p*H 1.0, 2.0 and 3.0. Rodriguez,[9] who subjected teeth to the action of 10 c.c. of hydrochloric acid, *p*H 3.8, and lactic acid, *p*H 3.9, stated that there was no change in the teeth at the end of the tenth week.

Very early in our experiments with teeth immersed in solutions of known reaction, we found that the acidity rapidly decreased after the introduction of the teeth, especially if the volume of the liquid was small and the entire tooth was exposed to the fluids. In order to determine the precise *p*H values that were capable of disintegrating enamel, we found it necessary to increase the volume as much as possible, to expose only a small surface of the tooth, to agitate the fluid continuously and to change the solutions whenever the *p*H values had appreciably changed. All this was made necessary because of the neutralizing effect of the tooth substance on the acid properties of the solution.

A series of teeth were subjected to the action of acid in the following manner:

1. Four teeth were covered with shellac, leaving one small area of enamel exposed (Fig. 3). These were placed in 150 c.c. amounts of lactic acid, which

12. Magitot: Researches sur la carie des dents, 1871.

13. Mummery: Proc. Roy. Soc. Med., 3: 71, 1909.

gave reactions of *p*H 2.5, 3.5, 4.5 and 5.8, respectively, after autoclaving. They were incubated at 37 C.

When only 150 c.c of liquid were used, it was almost impossible to maintain a constant *p*H value, even though the solutions were renewed daily. The enamel of the tooth at *p*H 2.5 in eleven days appeared very chalky; and, in three weeks, the enamel was disintegrated and the dentin exposed (Fig. 4).

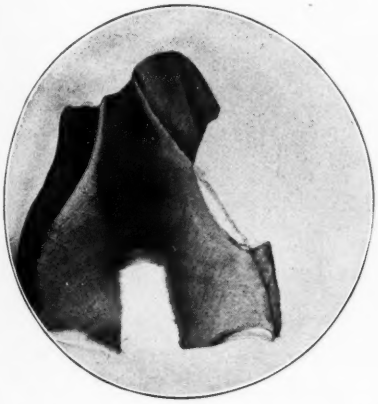

Fig. 4.—Tooth (covered) in lactic acid, *p*H 2.5, three weeks; × 7.

The teeth at *p*H 3.5 in five weeks showed a slight decalcification of enamel. Those in *p*H 4.5 and 5.8 solutions were discontinued on account of the fact that the solutions changed so rapidly that it was impossible to maintain constant *p*H values.

2. Single teeth were shellacked, exposing only a small opening and suspended in 500 c.c. Erlenmeyer flasks filled with lactic acid solutions of *p*H 3.8, 4.0, 4.4, 4.8 and 5.0. These were placed on a slowly revolving wheel, which kept the solutions in equal concentration throughout. The solutions were frequently tested and, whenever the *p*H values had markedly deviated from the standard in each case, the solutions were renewed.

The teeth in the *p*H 3.8 and 4.0 solutions showed marked changes over their entire exposed surfaces, becoming white and chalky in appearance in eleven days. Those in the *p*H 4.4 solutions showed definite localized whitening in the center of the exposed area in eleven days; while, in six weeks, the entire area was whitened and the surface had lost its natural luster. The teeth immersed in the solutions of *p*H 4.8 and 5.0 showed a much slower action, but in four and one-half weeks these were both distinctly etched.

From the foregoing results, it appears that many previous statements concerning the degree of acidity necessary for decalcification of enamel are erroneous and misleading. When proper measures were taken to insure a uniform strength of acid, it was found that marked disintegration of the enamel was produced in solutions of acid having a concentration of *p*H 5.0, but that the rate of action on the tooth is greatly enhanced by the employment of higher degrees of acidity. Extremely weak solutions of acid will decalcify the enamel of the tooth if prevented from neutralization by the inorganic constituents of the teeth and if allowed to act for a considerable length of time.

*Production by Different Strains of B. Acidophilus.*—We next attempted to produce artificial caries by subjecting teeth to the action of glucose medium cultures of *B. acidophilus*. Magitot,[12] in 1871, subjected teeth to the action of carbohydrate fermentations. The teeth were covered so that one area only was exposed. In this manner, he produced lesions quite similar to natural caries. Miller,[14] in his studies of caries in 1882 and later, produced artificial caries in teeth by immersing them for three

14. Miller, W. D.: Micro-Organisms of the Human Mouth, Philadelphia, S. S. White Co., 1890, p. 196.

months in mixtures of saliva and bread that were kept at 37 C.

McIntosh, James and Lazarus-Barlow,[10] in 1922, studied the action of *B. acidophilus* in its ability to produce caries of the teeth by suspending whole teeth in 2 per cent glucose broth cultures of that organism. In this manner, they obtained opacity of the enamel in seven weeks and undermining of the enamel with considerable destruction of the dentin in fourteen weeks. This, however, was not typical caries, since the decalcification proceeded from the pulp side toward the enamel. In their 1924 paper,[11] they reported a repetition of these experiments in which they covered a part of the tooth with celluloid varnish and obtained disintegration of the enamel and a partial destruction of the dentin in "fourteen weeks and under."

Fig. 5.—Tooth (uncovered) in B. acidophilus, Strain 16, twenty-four days; × 33.

Rodriguez,[9] in 1922, reported that, in his studies of caries, he suspended whole teeth in a 0.1 per cent agar and 1 per cent glucose culture of *B. acidophilus*, and that, at the end of four weeks, the teeth showed localized white areas and, in six weeks, there was a coalescence of individual white spots. In ten weeks, some of the teeth were slightly soft, while others were only whitened; and, in twelve weeks, there was local disintegration of the enamel and dentin.

In our experiments, we attempted to produce artificial caries resembling natural caries in every respect by the employment of strains of *B. acidophilus* isolated from carious mouths and standard cultures of *B. acidophilus* from other sources. We also studied the period required for decalcification and the manner of acid attack on the tooth substance.

Series 1. The roots of eight teeth were excised at the gingival line and the pulp chambers were filled with cement. These teeth were then sterilized in an autoclave, seven of them placed in seven tubes of 1 per cent glucose infusion broth *p*H 5.0, and inoculated, respectively, with seven strains of *B. acidophilus*. One tooth was placed in a similar medium, which was inoculated with the oidium-like organism previously mentioned. These tubes were incubated at 37 C and the teeth changed to fresh medium every two weeks.

In twenty-five days, three teeth showed a marked whitening over the crown, and the enamel of the cusps appeared dull and lusterless. Four teeth were slightly whitened, but all retained their external polish. The tooth in the oidium culture showed no change. In three months, all teeth in acidophilus cultures showed a general whitening, but the enamel was not perceptibly disintegrated (Fig. 5). The dentin at the cervical line, which had been exposed by the excision of the root, became brown and soft. The final reactions of the solutions varied from *p*H 3.8 to 4.4.

The tooth in the oidium culture showed no change at the end of three months. This culture maintained a *p*H of approximately 5.2.

In the experiments in this series the entire crown was exposed to the acids formed in the medium in which the teeth were immersed. The teeth in acidophilus cultures showed slight diffuse decalcifications. Certain parts of the tooth, especially the occlusal surfaces and the cusps, were attacked more than other parts of the crown; but in none of them

was there any evidence of localization or concentrated action leading toward typical cavity formation.

Series 2. Five whole teeth were sterilized and suspended in a 0.1 per cent agar and a 1 per cent glucose broth culture of *B. acidophilus*. The medium was changed every two weeks, the method adopted by Rodriguez[9] being employed. In one month, all five teeth showed whitening. In one case, the entire surface of the enamel was affected, while, in the other four, localized whitened areas were noted on the occlusal surfaces. The final reactions of the solutions varied in *p*H from 3.4 to 4.2. At the end of two months, there was a more general whitening of the enamel and a loss of external luster. In four months, all teeth showed a general decalcification of the external surface of the enamel, but, on sectioning the teeth, the penetration of the acids was found to be very superficial.

Fig. 6.—Tooth in B. acidophilus, Strain 16, twenty-four days. Shellac covering removed.

When, as in the two foregoing series of tests, the entire crown of the tooth is exposed to the action of the acid, the acids formed by fermentation are markedly lowered in their *p*H values by contact with the inorganic constituents of the tooth. In none of the teeth under our observation was there any marked localization of decalcification or any evident cavitation of the enamel except that the occlusal surfaces were more whitened than the remainder of the crowns of the teeth. It is evident, then, that in such tests the decalcifying powers of the acids formed by *B. acidophilus* fermentation are not adequately evaluated, in that the acids are not confined to a given area, as in natural caries, but, rather, act on a large area of the tooth and are thereby lowered in their *p*H values. Moreover, their action on the tooth is not typical of natural caries; nor are the lesions produced in any way comparable to the process of dental caries *in vivo*. Consequently, it appears that, if we wish to simulate natural conditions *in vitro*, the action of the acids of fermentation must be limited to a given area of the enamel and, if the maximum efficiency of *B. acidophilus* is to be determined, the acids produced must not be neutralized by contact with other portions of the tooth.

Fig. 7.—Tooth (covered) in B. acidophilus, Strain 49, twenty-four days; × 7.

The method adopted to accomplish this purpose was to cover all portions of the tooth with shellac with the exception

of a small window from 3 to 5 mm. in diameter, exposing a surface of normal enamel (Fig. 3). The tooth thus prepared was placed in glucose broth, inoculated with a strain of the organism to be tested. In this manner, the exposed part of the tooth was subjected to the full strength of acids formed in the liquid medium in which it was suspended. This method insures the localization of the acids on a particular surface of the tooth, but it does not fully comply with natural conditions, in that, in the mouth, a tooth is probably never subjected to such large quantities of acid, and the acids are of higher concentration than would be found in the mouth, since, under normal conditions, they are subject to more or less neutralization by the saliva. Any lesion formed by this method is unquestionably an exaggerated picture of the natural process and is far more severe than usually occurs in the mouth. However, it affords some points of similarity to natural conditions, and, since no better means of duplicating the process experimentally occurred to us, we adopted this method in our study of the behavior of *B. acidophilus* in dental caries.

The tests made are described as follows:

Series 3. Eight teeth were prepared by excising the roots, introducing a pointed glass rod into the pulp canal and covering the entire tooth with shellac, leaving one small area of the tooth exposed. These were then placed in tubes of infusion broth *p*H 5.0, with 1 per cent each of glucose, sucrose and lactose. Seven tubes were inoculated with seven different strains of *B. acidophilus* and one with a combination of three strains. The medium was changed every two weeks. In twenty-four days, the exposed area of the enamel in all eight teeth was completely decalcified and the underlying dentin was markedly softened (Figs. 6, 7 and 8).

Fig. 8.—Tooth (covered) in B. acidophilus, Strain 16, twenty-four days; × 33.

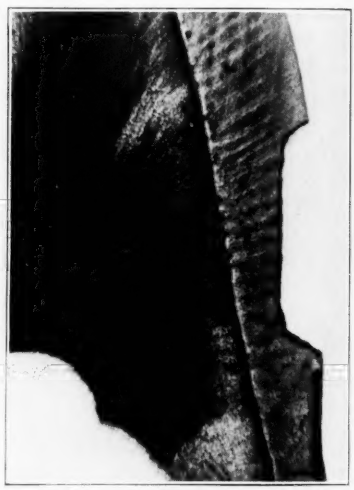

Fig. 9.—Tooth in B. acidophilus, Strain 16, six days; × 33.

Series 4. Four teeth were similarly shellacked and placed in a triple sugar broth, inoculated with one strain of *B. acidophilus.* In six days, there was evident decalcification of the enamel, which extended approximately one-half the distance from the external surfaces to the dento-enamel junction. A section

Fig. 10.—Tooth in B. acidophilus, Strain 16, eight weeks (action restrained); × 33.

of one of these series is shown in Figure 9. It will be noted that the action on the enamel is more intense than is usually seen in normal caries in that, in the early stages of the process, the enamel is taken out *en masse* and there is no indication of a preliminary deep penetration of the interprismatic surfaces, which is characteristic of natural caries. This is probably due to the fact that the acids concerned are of greater concentration than are those of natural caries. In order to produce artificial caries that more nearly approximates the conditions existing in the mouth, the degree of acidity must be reduced by some form of partial neutralization so that the acid action on the teeth will be slower and more deeply penetrating. To meet these conditions, we made the following series of tests.

Series 5. Four teeth were shellacked as above and were placed in tubes of

Fig. 11.—Tooth in B. acidophilus, Strain 58, five and one-half months (action restrained); carmine strain; × 7.

glucose broth in which another whole uncovered tooth was placed to neutralize the acids formed and reduce the intensity of the attack on the exposed enamel of the covered tooth. These were inoculated with *B. acidophilus,* and the medium changed every two weeks. In eight weeks, the enamel was superficially decalcified. There was considerable penetration of the acid into the enamel, but the form was not lost. On sectioning the tooth, the superficial portion of the decalcified area was lost in grinding, as shown in Figure 10. Certain of these teeth that were carried for five and one-half months under these conditions showed a complete loss of enamel in the

exposed area with involvement of the underlying dentin (Fig. 11).

Series 6. In order to ascertain whether the disintegration of the enamel in glucose broth cultures of *B. acidophilus* was due to the acids formed, or to the mass action of the organism itself, the following test was made. Four teeth were selected as above with the exception that two "windows" were left, one on the buccal and another on the lingual surface of the tooth. These were immersed in triple sugar broth cultures of *B. acidophilus* and one of these areas was brushed daily with a sterile toothbrush. The other was allowed to remain unmolested. In this manner, we sought to determine the relative effect of organisms and their acids continuously in contact with tooth tissues as compared with the action of the acids on surfaces where the bacterial cultures were frequently disturbed.

In eight days, it was noted that the exposed area of the enamel that had been brushed was decalcified practically one-third of the distance through the enamel, with a distinct loss of tissue; while the unbrushed area on the opposite side of the tooth was still intact and showed but slight penetration. A section of one such tooth is shown in Figure 12. In other teeth carried nineteen days, the brushed side showed penetration entirely through the enamel, with penetration of the dentin toward the pulp; while the unbrushed side showed but slight penetration of the enamel and no loss of substance (Fig. 13). It is apparent that when the organisms were left in contact with the tooth where they might exert a mass action, the penetration was far less than under those conditions in which the bacteria had been periodically disturbed. It must be clearly understood that this in nowise has a bearing on the action of the toothbrush in the mouth, since the conditions of the experiment are quite different from those *in vivo*. In natural caries, we are dealing, not with the action of a large volume of fluid, such as the saliva, but with small quantities of acids that are localized and protected from neutralization by the fluid environ-

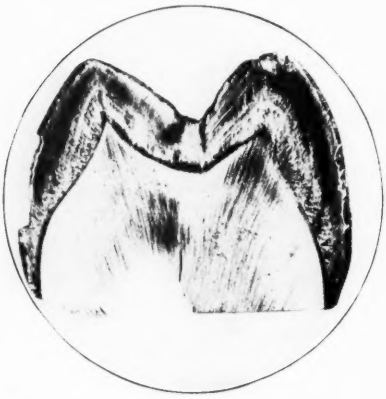

Fig. 12.—Tooth in B. acidophilus, Strain 16, eight days; two openings; left side brushed; × 7.

Fig. 13.—Tooth in B. acidophilus, Strain 49, nineteen days; two openings; left side brushed; × 7.

ment of the tooth. In the experiments *in vitro,* the tooth is attacked by a volume of acid solution that seemingly, in its decalcification of the enamel, produces a protective residue on the affected surface that inhibits the subsequent action of the acids. When the surface is periodically brushed, this protective residue is removed, and the attack of the acid on the exposed surface is thereby accelerated. Thus the brushing of the tooth under experimentation removes its

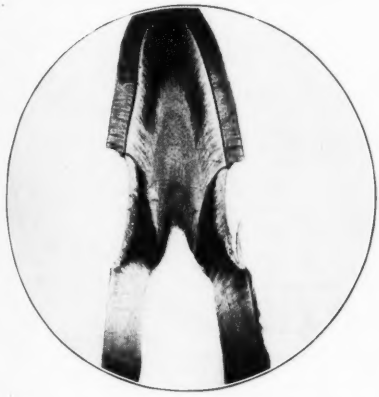

Fig. 14.—Dog tooth in dog strain of B. acidophilus, six weeks; × 7.

protection and subjects it to fresh contact with the acid solution; while the brushing of teeth in the mouth removes the means of acid formation and affords contact of the saliva, which exerts a neutralizing action on the acid. The results of the experiment indicate that the disintegration of the enamel in *B. acidophilus* cultures is purely a decalcification and that mass action of the organisms plays little part in the process.

Series 7. One canine tooth of a dog was shellacked as above, leaving two openings, and placed in triple sugar broth inoculated with a strain of *B. acidophilus* that had been isolated from a dog's mouth. The medium was changed every two weeks, as in the previous tests. In three weeks, there was a slight whitening of the exposed enamel; and, in six weeks, there was an entire loss of the area of the enamel that was exposed, and a partial destruction of the dentin immediately below. The solution maintained an acidity of about *p*H 4.6. A section of the tooth after six weeks is shown in Figure 14.

Series 8. One tooth was shellacked as above and placed in triple sugar broth

Fig. 15.—Tooth in mixed culture of B. acidophilus and oidium-like organism, five months; carmine stain; × 7.

that was inoculated with a strain of *B. acidophilus* obtained from a commercial laboratory. This strain is used for the production of acidophilus milk. The tooth used in this series had an especially hard and polished enamel surface.

In three weeks, there was a slight whitening of the exposed enamel. In two months, the enamel was still intact and the surface maintained its hard and lusterless exterior. In six months, there was a superficial decalcification with a slight loss of tissues. The acidity of the solution remained about *p*H 3.8. The external hardness of this tooth no doubt

offered considerable resistance to the action of the acid.

Series 9. One tooth was shellacked as above and placed in triple sugar broth that was inoculated with *B. coli*. In six weeks, the exposed enamel was slightly dull but remained intact, and, in five and one-half months, the exposed area was markedly whitened, but there was no loss of enamel substance. The acidity of the solution never fell below *p*H 4.6.

Fig. 16.—Tooth in B. acidophilus, ten weeks and in Staphylococcus albus, seven weeks; × 7.

Since *B. acidophilus* in caries is so frequently associated with other micro-organisms, a small series of tests was carried out in which teeth were subjected to cultures of *B. acidophilus* and other common mouth bacteria to determine whether the course of tooth destruction would be modified thereby. In Figure 15 is shown a tooth that was subjected for five months to the action of a combined culture of *B. acidophilus* and the oidium-like organism. It will be noted that the dentin is deeply penetrated by the action of the two organisms. Figure 16 is a section of a tooth that was subjected for ten weeks to a *B. acidophilus* culture and then transferred for seven weeks to a culture of *Staphylococcus albus*. By this method, a marked destruction of the dentin undermining the unexposed enamel was obtained, more pronounced than is usually found in pure cultures of *B. acidophilus*.

To determine further the ability of acids produced by *B. acidophilus* to decalcify tooth substance without the immediate proximity of the organisms themselves, a tooth was subjected to the action of acids produced by fermentation but separated from the micro-organisms by a dialyzing membrane. A collodion sac was fastened to a 15 mm. glass tube and was filled with a 1 per cent glucose infusion broth, reaction unadjusted (*p*H 6.2 to 6.6). Within the sac was suspended a tooth, which was covered with shellac except for one area. The sac with its contents was then placed in a large sterile test tube in which there was about 20 c.c. of glucose broth, sufficient to cover the introduced collodion sac above the line of attachment. The entire assembly was then autoclaved. The medium in the test tube, outside the collodion sac, was inoculated with *B. acidophilus* and the assembly was incubated at 37 C. An active growth of *B. acidophilus* took place in the medium outside the collodion sac, but that portion within the sac remained sterile, and was changed only by an osmotic diffusion of the acids, formed outside, through the collodion membrane into the fluid in which the tooth was bathed. In this manner, the tooth was subjected to the products of bacterial fermentation and not to the direct action of the bacteria themselves. Two set-ups were made, with two different strains of *B. acidophilus*.

In six days, one tooth showed distinct whitening of the entire exposed area, while the second showed slight changes on the periphery of the exposed enamel. In eleven days, the exposed enamel of the first tooth was entirely softened and was brown, while the second tooth was

chalky but still remained hard. In three weeks, the enamel of the first tooth was entirely decalcified. A section is shown in Figure 17. The second tooth showed a slight loss of enamel, less than that of the first. These results show clearly that any disintegrating power that *B. acidophilus* may have on the enamel is due to the action of its acids and not to any direct action of the organisms themselves in contact with tooth substances. This experiment also indicates

Fig. 17.—Tooth in collodion sac; B. acidophilus, Strain 16, outside, three weeks; × 7.

that the acids formed in the fermentation of carbohydrates by *B. acidophilus* are readily diffusible through semipermeable membranes.

*Summary.*—From these experiments, it would appear that lesions in the enamel may be artificially produced by various concentrations of lactic acid within the natural range of acid fermentations, and also by the acids produced in the fermentation of sugar mediums when such acids are confined to a specific location on the tooth. It must be admitted that by neither of these methods has anyone so far published a record of initial, artificial, enamel caries in which there has been a reproduction of the flamelike or cone-shaped penetration of the interprismatic substance of the enamel before there was a loss of enamel substance, identical with that seen in natural caries. Two factors may be lacking in all such experiments; which prevents the reduplication of the natural processes, namely, differences in acid concentration, and the lack of a possible physical interaction between the fluids of the pulp of the tooth and the acids on the exterior of the enamel. It has long been our opinion that typical, initial caries identical with that which occurs in vital teeth cannot be produced *in vitro* unless the conditions of osmotic tension of the dentin and enamel are made similar to those of the natural teeth; for in none of the artificial decalcifications so far recorded have we ever noted any distinct "pointing" of the acid invasion. Rather has the enamel been attacked in a uniform fashion, the farthest line of attack being parallel to the original enamel surface, as will be noted in many of our illustrations. This, as we have said, may be due to the high concentration of acids which were present in the experiment, but in our opinion it is also the result of an absence of certain physicochemical reactions which would be found in the living tooth. In other words, caries *in vitro,* in all probability, resembles caries in pulpless teeth more than the process as it occurs in teeth with vital pulps. We have made many attempts to reproduce normal conditions by introducing physiologic sodium chlorid solution into the pulp chambers of teeth, while they were being subjected to the acids of fermentation; but thus far our results for the most part have been disappointing and we have failed to produce an initial lesion of artificial caries that is similar in all respects to that of the normal process. A slight indication of pointing may be seen in Figure 10, in which a salt solution was introduced into the pulp cavity during the experiment.

However, the results attained fully

substantiate the claims of McIntosh, James and Lazarus-Barlow[8] and those of Rodriguez[9] as to the ability of *B. acidophilus,* when growing unmolested in contact with tooth tissue in a carbohydrate medium, to produce rapid disintegrations of the enamel. From the evidence so far submitted, it seems reasonable to conclude that the conditions that have been produced in the laboratory obtain in the mouth, perhaps to a less degree or in a modified form; and that *B. acidophilus* is unquestionably a powerful agent of tooth destruction.

### III. THE CULTURAL AND MORPHOLOGIC CHARACTERISTICS OF B. ACIDOPHILUS.

The organism now recognized as the type species of *B. acidophilus* was first reported as a new species by Moro,[15] in 1900. It was isolated by him from the stools of nurslings and appeared as a short rod varying in length from 1.5 to 2.0 microns and in breadth from 0.6 to 0.9 microns in young cultures. In older cultures, he described long, fine threads, which, under certain conditions, showed true branching. There were also present club-shaped, screw-shaped, horseshoe and ring-shaped forms, the organism thus manifesting a high degree of pleomorphism, to which he called particular attention. Because of its true branching, he allied the organism with the streptothrix group, and related it to the tubercle and diphtheria bacillus.

In 1901, Rodella,[16] also working with strains of *B. acidophilus* from stools of infants, confirmed most of the work of Moro and reiterated the point of pleomorphism. He concluded that the form assumed was dependent on the kind of culture medium. He showed that, in young broth cultures, the organism appeared as short, discrete rods; while, in old cultures, there were formed long threads or chains, the individual elements of which varied from thick rods to coccus-like forms. Rodella also reported branching, especially in older cultures.

Kendall,[17] working with intestinal strains of acidophilus, reported (1910) that the organism was usually a slender bacillus with tapered ends, but that branched forms occurred in old agar cultures and threads and chains in old broth tubes. Kendall thus also supports by his data the quality of pleomorphism.

In 1924, Cannon[18] reported the observation on intestinal strains that individual strains varied somewhat from one another, but that the morphology of a single strain tended to remain constant. Cannon apparently failed to see branching forms and regards the established acceptance of pleomorphism of the acidophilus as premature.

Kulp and Rettger,[19] working with strains from the intestinal tract, concluded that the size of the organism depended on the medium, varying from short rods to long filaments, with granule formation in older cultures. No branched forms were seen. They studied, in addition, one strain obtained from dental caries, but no divergencies in this strain are mentioned.

The first investigator to report on the morphology of *B. acidophilus* coming particularly from the human mouth or from dental caries, was Kligler[6] (1915), who listed sixty strains and again emphasized the quality of pleomorphism, calling attention to the influence of anaerobiosis on the production of filaments. Kligler did not mention the branched forms of the organism.

15. Moro, E.: Jahr. f. Kinderh., 52: 38, 1900.

16. Rodella: Centralbl. f. Bacteriol., 29: 717, 1901.

17. Kendall, A.: J. Med. Res., 22: 153, 1910.

18. Cannon, P. R.: Biologic Study of Aciduric Bacteria, J. Infect. Dis., 34: 227 (March) 1924.

19. Kulp, W. L., and Rettger, L. F.: Comparative Study of Lactobacillus Acidophilus and Lactobacillus Bulgaricus, J. Bacteriol., 9: 357 (July) 1924.

Howe and Hatch,[7] who reported, in 1917, on the morphology of *B. acidophilus* from carious teeth, stated that the organism is not so pleomorphic as has been supposed, but remains commonly as a short, thick bacillus. They described three distinct morphologic types of organisms, all of which they placed in the Moro-Tissier group, along with the typical *B. acidophilus* and *B. bifidus*. These were: 1. *Bacillus X*, which appeared as long chains of short bacilli, as long unbroken threads and occasionally as streptococci. In this form, they admitted some degree of pleomorphism. 2. *Bacillus M*, a small, slightly curved rod in pairs with the concave sides facing one another. 3. *Bacillus Y*, which was encountered "but once or twice," and thus scarcely warrants consideration.

McIntosh, James and Lazarus-Barlow[10] (1922), also working with cultures from dental caries, isolated two types of aciduric organisms, which they chose to name *B. acidophilus-odontolyticus*, Types I and II, thus implying a biologic difference from the *B. acidophilus* of Moro, as well as the *B. acidophilus* of Kligler; although they stated that 60 per cent of Type I strains resembled in sugar fermentation the organisms of Kligler, and it is clear that no noteworthy morphologic differences obtain. Branching was not mentioned as having been observed by McIntosh and his collaborators, but it is stated that, in alkaline mediums, streptococcal and diplococcal forms occurred; whereas, in acid mediums, the bacillary forms were usually the only ones present.

In 1922, Rodriguez[9] reported a study of several strains of *B. acidophilus* from dental caries. Using the newer nomenclature, he termed his organisms *Lactobacillus odontolyticus*, which he divided into Types I, II and III on the basis of morphologic grounds only. Rodriguez claimed these differed not only among themselves but also from the typical stock strains of *B. acidophilus* of Moro. While his Types I and III resemble the two types of McIntosh and his collaborators, his Type II, a curved bacillus, is undoubtedly the organism described by Howe and Hatch under *Bacillus M*. Regarding pleomorphism, Rodriguez stated that his Types I and III may show pleomorphism when more than twenty-four hours old. The nature of the pleomorphic changes are not described.

*Summary of Review of the Literature.*—In summarizing this brief review of the literature dealing with the morphologic features of *B. acidophilus*, the following points are clear: 1. There is no unanimity of opinion as to the typical form of the organism. 2. There is divergent opinion regarding both the fact and the degree of pleomorphism. 3. There are divergent reports regarding the important matter of branching, on the basis of which the organism is relegated to one or another of the large bacterial groups. 4. These facts hold for the aciduric organisms isolated from dental caries as well as for those related to the older "acidophilus type." 5. The extreme confusion in the views regarding the morphologic and biochemical characteristics of the aciduric organisms obtained from dental caries is reflected in the difficulty of naming the organism and the facility with which new and unwarranted nomenclature is applied at random to newly "discovered" types.

In view of the confusion of opinion regarding the variation in morphology of *B. acidophilus* (whether of Moro or of recent investigators), and in view of the various names and groupings of the organism as found in dental caries, we have made observations on a group of aciduric cultures obtained from carious and noncarious mouths, mainly to ascertain whether subgroups of this organism on the basis of morphologic type are at present justifiable.

*Cultural Characteristics. — Bacillus*

*acidophilus,* in strains isolated from the human mouth, as we have studied them, appears as a rather slender rod having a length of from 0.4 to 13 microns and a breadth of from 0.4 to 0.6 microns. It may appear also in the form of cocci or long filaments, branched or unbranched, as we shall describe later. Rods showing granulations are also common. The organism is nonmotile and ordinarily gram-positive.[20] In glucose and whey broth, growth appears in from twenty-four to forty-eight hours and is heavier at the bottom of the tube, and along the side walls. In from three to five days the growth settles to the bottom in a whitish and coherent mass, leaving the supernatant medium clear or with minute clumps on the side walls. In sugar broth, abundant acid is often formed, as will be mentioned later.

In gelatin stab cultures, there is a very faint filiform growth and no liquefaction. The growth in a glucose agar stab culture is more abundant and is uniform from top to bottom. Long branching filaments are seen in stained preparations from old stab cultures (Fig. 21). These forms are stained with difficulty and are entirely destroyed if the slide is fixed with heat. Methylene blue (and only certain batches of it) was the only stain with which we were able to demonstrate them. In these branching filaments, and associated with them, were observed granules and bud-like outgrowths, the nature of which is still obscure.

On glucose agar slants, a delicate streptococcus-like growth appears in from two to three days at 37 C. The consistency is butyraceous but somewhat dry. On casein digest-sodium oleate agar, there is a heavier, more moist, whitish growth following the lines of inoculation. The latter may also show branched forms in old cultures.

Colonies on glucose agar plates appear in forty-eight hours, or later. They are of several types, most of which are from 0.5 to 1.0 mm. in diameter, but usually larger on whey or casein digest agar. The surface colonies are white, smooth slightly convex, with regular margin and a glistening luster. Viewed microscopically, they are finely granular.

The deep colonies are usually of two distinct types: (1) small, disk-shaped and compact, with even margins and no radiations, and (2) small, irregular in shape and possessing filamentous radiations from the center. This type has been termed by McIntosh and his collaborators the "tam-o-shanter" colonies. In replating from either the "regular" or "irregular" types of colonies, both regular and irregular colonies are produced.

Other cultural features will be mentioned in the section dealing with the biochemical reactions of the organism.

*Variations in Morphology Occurring at the Time of Isolation.*—In studying the morphologic variations of organisms from a definite source, it is obviously of importance to learn the nature of the variations that appear at the time of isolation, as well as those that occur after a longer or shorter period of time on artificial mediums.

All strains were grown for the first few days in 1 per cent glucose infusion broth of *p*H 5.0, into which the original inoculation from the teeth was made. As soon as growth had occurred, usually within forty-eight hours, stained preparations were made. These usually showed various types of rod forms, sometimes mixed with the oidium-like organism or with streptococci. There were long, slender rods from 0.4 to 0.6 microns by

20. The gram reaction is found to depend on the *p*H value of the medium. In the usual acid medium, it is gram-positive in young cultures, gram-negative in old. It is quite possible to reverse the gram reaction of the organism in old (and more acid) cultures merely by treating the medium or the bacterial film on the slide with dilute sodium hydroxid. This is in harmony with the recently reported experiments of Stearn and Stearn (J. Bacteriol., 9: 463, 1924) for other organisms.

from 2.5 to 5.0 microns. Sometimes these were oriented end to end in short chains and sometimes they were single (undoubtedly what McIntosh and his collaborators, and Rodriguez call their Type I). There were also short, thick bacilli from 0.4 to 0.6 microns by from 0.4 to 2.5 microns, occurring often in chains, and showing marked palisade arrangement (probably the Type II of McIntosh and his collaborators, and the Type III of Rodriguez). Some cultures showed occasional curved and ring-shaped forms such as those described by Moro in his first paper, and also described by Rodriguez as his Type II, and, as *Bacillus M.* S-forms, were also frequently noted by Howe and Hatch; the last were doubtless the same as Moro's "corkscrew forms." That these various forms, on first isolation, were all members of the acidophilus group and not adventitious mouth bacteria was shown by the fact that certain of these cultures, showing the various types of bacilli, when plated on glucose whey agar, gave only typical acidophilus colonies. It thus appears that, even at the time of first isolation, these organisms may manifest a highly variable morphology.

Fig. 18.—B. acidophilus, Strain 16, three days in whey agar; fuchsin stain; × 1,500.

Fig. 19.—B. acidophilus, Strain 16, five days in glucose broth; gentian violet stain; × 1,500.

*Variations Occurring After Isolation but Following Continuous Cultivation on the Same Medium and Following Changes of Culture Medium.*—At times, when plating could not be carried out as soon as growth appeared in the isolation broth, the cultures were carried on for some time in the original acid medium. Subsequent examinations of the broth revealed only streptococcal forms, composed sometimes of perfectly round, sometimes slightly elongated, elements. At first, some of these strains were discarded, as it was thought that a streptococcus had overgrown the acidophilus. It was soon observed, however, that when the cultures were plated on glucose whey agar, only typical acidophilus colonies appeared, showing the rod forms; and, moreover, that when these colonies were seeded back into broth, they gave again the streptococcal type. The streptococcal form was, therefore, only a stage or phase, in the life history of the rod form.

Regardless of how many morphologic varieties existed in the original broth,

when plated on agar, the same two types of colonies appeared—the regular and the irregular. Smears from many of each type revealed the same range of morphologic variation in the organisms, no difference being correlated with the type of colony. Moreover, the types of organisms observed in broth culture did not necessarily reproduce themselves in separate colonies obtained from plating that broth. For instance, if Types I and II (McIntosh) were present in broth, either I or II might reproduce both I and II types. Figure 18 shows Strain 16 from a colony on a 3-day whey-agar plate. The rods in this colony varied in length from 0.4 to 4.5 microns with some thread forms of 13 microns, while the breadth tended to remain constant, varying from 0.4 to 0.6 microns.

Our strains were carried on casein-digest agar with 0.1 per cent sodium oleate and 1 per cent glucose added, recommended by Hunter[21] as the most favorable medium for the cultivation of the lactobacillus group. This was the only medium on which any of our strains showed the curved bacillus ("horse-shoe" and "ring-shaped" type of Moro)—observed occasionally in the "isolation" broth—growing as the predominant form. Several of our strains which, after isolation from a colony on agar, had been carried in broth for some time, and had never shown the horse-shoe form, on their first transfer to casein-digest agar slants, showed for several days this peculiar type as the most prominent form. After a few days' growth, however, they straightened out into, or were replaced by, a short, straight bacillus. Figure 18 shows Strain 16 from a three-day colony on whey-agar. The rods manifest the typical parallelism and the two sizes mentioned by McIntosh and co-workers as their Types I and II. They also conform to the Types I and III of Rodriguez. They resemble also the "*B. acidophilus*" described by Howe and Hatch. Figure 19 shows the same strain (16) from a five-day glucose broth of *p*H 5.0, demonstrating the streptococcus-like chains. Figure 20 presents the same strain from a five-day

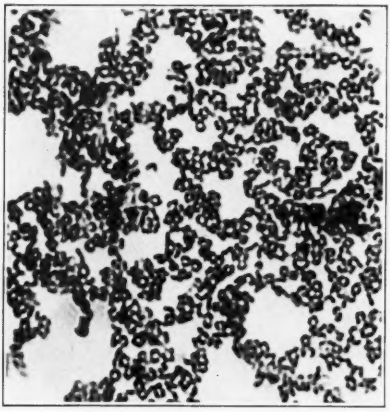

Fig. 20.—B. acidophilus, Strain 16, five days in casein-digest agar; gentian violet stain; × 1,500.

Fig. 21.—B. acidophilus, Strain 16, three months in glucose-agar stab culture; methylene blue stain; × 1,500.

21. Hunter, C. A.: Abstr. Bacteriol. 8: 3, 1924.

casein-digest agar slant, showing the horse-shoe bacillus described by Howe and Hatch as their *Bacillus M;* by Rodriguez as his *Lactobacillus odontolyticus,* Type II; and by Moro, who described these horse-shoe and ring-shaped figures in *B. acidophilus,* attributing them to degeneration changes in slant agar. Figure 21 shows the branched filaments of Strain 16 from a three-months glucose-agar stab culture, stained with methylene blue without fixation. This clearly indicates that Howe and Hatch's *Bacillus M* is not a type distinct from their "*B. acidophilus*"; and, moreover, that there is no justification in recognizing a difference in the two types of McIntosh and his co-workers, or the three types of Rodriguez, on a morphologic basis.

When the streptococcus type occurring in broth was transferred to milk, an increase in short, thick elements, which were independent and distinctly rod shaped, usually resulted; also, long filamentous forms appeared, some of which were heavily and uniformly stained with gentian violet, while others stained lightly, showing, however, heavily stained granules lying in the filaments.

*Variations Caused by Other Modifications in the Medium.*—Other factors that might have an influence in changing the morphology of the organism have been studied only briefly, and final conclusions cannot be drawn from the present data. The effect of varying degrees of reaction of medium, coupled with slight changes in the salt content, were studied, the *p*H variations being 5.0 and 7.4; while the salt concentrations for each of these values were 0.2 per cent, 0.5 per cent and 1 per cent. In these mediums two strains of acidophilus were studied, both of which, at the beginning of the tests, appeared as streptococcal forms in the broth culture from which the inoculations were made. Observations were made at intervals for a period of two weeks, and, within this time, no morphologic changes were noted, all cultures continuing to show the streptococcal form. It may be recalled that McIntosh and his co-workers observed streptococcal forms in more alkaline broth and mainly rod forms in more acid broth.

In this connection, it may also be noted that, very recently, Clarke[22] has reported his conclusion that the causative agent in dental caries is a streptococcus—*S. mutans* (new species). He states

Fig. 22.—B. acidophilus, Strain 34, five days in glucose broth, under oil; fuchsin stain; × 1,500.

that "When grown on a medium with a neutral or alkaline reaction, *S. mutans* is a noncapsulated coccus, about 0.75 microns in diameter, growing in chains of medium length; if, however, the medium becomes acid, it assumes the form of a bacillus. The length of the bacillary form varies from 1.5 to 3 microns or more, being greater on a solid than in a liquid medium." The actual *p*H values of the medium favoring these changes are not given, although it is stated that this new organism will not

22. Clarke, J. K.: Bacterial Factor in the Etiology of Dental Caries, Brit. J. Exper. Pathol., 5: 141 (June) 1924.

grow at a reaction below *p*H 5.6. In the light of our own and many other studies, it can scarcely be doubted that Clarke was working, in some instances at least, with *B. acidophilus*. Further reference will be made to his conclusions.

Cultivation in glucose broth under oil, in several instances served to produce longer streptococcal chains than appeared in broth without oil. These

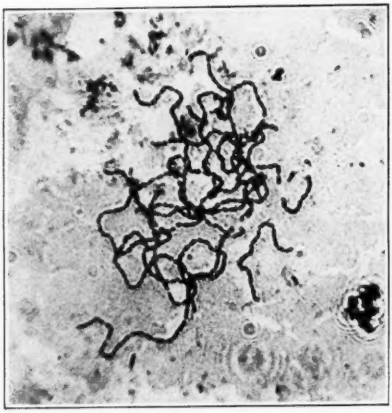

Fig. 23.—B. acidophilus, Strain 34, two days in glucose broth; fuchsin stain; × 1,500.

are shown in Figure 22, where the tangled chains of Strain 34 are observed. These long chains are charactertistic also of *Bacillus X* of Howe and Hatch. Figure 23 shows the shorter chains in glucose broth without oil.

On solid culture mediums, such as casein-digest agar, there is a tendency toward the appearance of the rod type. With increasing age, the rods appear to become shorter and, in addition, coccal forms appear. For instance, Strain 49, when isolated in broth, appeared as a long, straight rod, conforming to the Type I of McIntosh and his collaborators, the Type I of Rodriguez, and "*B. acidophilus*" of Howe and Hatch. However, it became transformed to the streptococcal form in broth. A transfer to a casein-digest agar slant brought back its original long, straight form, as shown in Figure 24. Figure 25 shows the coccal forms reappearing in a twenty-two day casein-digest agar slant, conforming now to the Type II of McIntosh and his co-workers, Type III of Rodriguez, and *Bacillus X* of Howe and Hatch. Figure 26 is another strain

Fig. 24.—B. acidophilus, Strain 49, two days in casein-digest agar; fuchsin stain; × 1,500.

showing this short streptococcal form from an old agar slant.

From these few data, it appears that a single strain of *B. acidophilus* may appear in many forms and that the composition and manner of use of the culture medium may play an important part in determining these transitions.

*Summary*—Our observations coincide with those of the several investigators who see in *B. acidophilus* evidence of a highly developed pleomorphism; moreover, this variability is manifested not only by strains from different sources, but also by one and the same strain growing under different conditions. The

degree of pleomorphism observed in strains isolated from dental caries is apparently no less than that originally observed and reported by Moro for his type species of *B. acidophilus,* and confirmed by Rodella and others. Since so great a morphologic variability obtains in the single strain, we can at present see no secure basis for division of the species into "types" purely upon a morphologic basis, as has been attempted of late by several workers. The significant types are those which may be founded on biochemical rather than morphologic features. In this sense, the types of Howe and Hatch, and those of Rodriguez, possess little actual significance. Just what environmental conditions determine the morphologic type, at a given moment in its life history, is not yet entirely clear, and the view must be held open that there may exist in *B. acidophilus* a sort of life cycle, analogous perhaps to those observed by Löhnis[23] for other bacterial forms. This aspect of the matter demands further study.

23. Löhnis, F.: Memoirs Nat. Acad. Sc., 16, 1921.

In this connection, it may be added that the pleomorphism of *B. acidophilus* has in the past doubtless been the cause of many errors in the recognition or identification of micro-organisms from the mucous membranes of the mouth and throat. A brief experience with acidophilus as it occurs in the mouth is sufficient to show the ease with which it may, in stained preparations, and even in culture on blood serum, be mistaken for the diphtheria bacillus or for organisms of the Hoffmann type. Many slides defy a microscopic separation. It can scarcely be doubted that frequently, in the past, organisms identified as the acid-forming so-called Hoffmann types, or pseudodiphtherial organisms, have actually been the palisaded rods of acidophilus, and that many a perfect streptococcal chain has actually been the streptococcus phase of the same organism. It is no doubt some such confusion that has led Clarke to postulate his new streptococcus species—*Streptococcus mutans*—assumed by him to be the primary causative agent in dental caries, and reported as appearing in coccus form in an alkaline me-

Fig. 25.—B. acidophilus. Strain 49, twenty-two days in casein-digest agar; fuchsin stain; × 1,500.

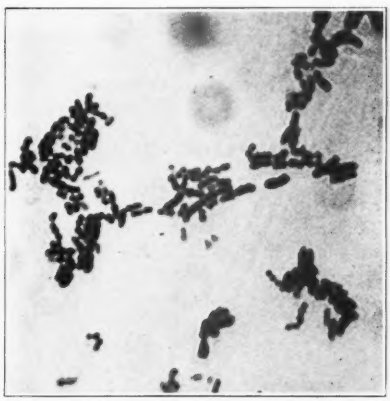

Fig. 26.—B. acidophilus. Strain 21, ten days in casein-digest agar; fuchsin stain; × 1,500.

dium, while it masquerades as a rod in acid broth. This circumstance is nothing new to those who have critically observed the pleomorphism of acidophilus, with its morphologic transformation from rod to coccus and coccus to rod when submitted to reaction changes in the medium, or to other cultural modifications. Until this circumstance is more fully appreciated by investigators, *B. acidophilus* will continue to appear in the guise of new types, and ever in the cloak of a new bacterial species.

A word may be said regarding the systematic position of the organism. It can scarcely be doubted, not only that acidophilus is highly pleomorphic, but also that it presents a true branching, as first stated by Moro. In such case, it belongs, perhaps, in the group of mycobacteriaceae, along with the bacillus of diphtheria, although Moro first related it to the streptothrix group, and Rodella has mentioned the similarity between acidophilus and actinomyces. In any event, its true nature is obscured by affiliating this organism with the group of lactobacillae, as was done in the most recent classification.

### IV. THE BIOCHEMICAL CHARACTERISTICS OF B. ACIDOPHILUS

Although, as we have seen, it appears impossible to separate the aciduric organisms into types on the basis of their morphology, it seemed that better success might be obtained when biochemical differences were taken as the basis of differentiation. Indeed, this has been attempted by various workers. Kligler[6] was the first to divide strains of acidophilus from the teeth on the basis of fermentation tests. Using glucose, sucrose and lactose, he found, among fifty-eight strains, the following reactions: twenty fermented glucose, sucrose and lactose; thirty-five were sucrose-negative, fermenting only glucose and lactose; and three fermented glucose only.

McIntosh and his collaborators[10] studied the fermentation reactions of fifty-six strains from carious teeth, thirty-eight of which had been classified as Type I on the basis of morphology, and eighteen as Type II. The majority (thirty-three) of the Type I strains fermented glucose and lactose, but not sucrose. Only two fermented all three sugars, and three fermented glucose and sucrose but not lactose. Of the eighteen Type II strains, twelve fermented all three sugars, one fermented glucose and lactose, two fermented glucose and sucrose and three fermented glucose only. In these tests, it might appear that the chief fermentative reaction correlated with morphologic type was sucrose fermentation, 89 per cent of the Type I strains being sucrose-negative, while 78 per cent of the Type II strains were sucrose-positive.

Later, the same authors reported that, after prolonged subculture on a sucrose medium, previous sucrose-negative strains became sucrose-positive. Cannon,[18] who had worked earlier with strains from the intestines and sputum, had expressed the opposite view—that the original reaction remained unchanged even after a period of one year. In an attempt to show biochemical differences between their *B. odontolyticus* from the mouth and *B. acidophilus* (Moro) from other sources (mainly the intestines), McIntosh and his collaborators[11] performed fermentation tests on other sugars and reported differences in raffinose, dextrin and, to some extent, sucrose. These were less readily fermented by strains from the mouth than by strains from the intestines. Cannon[18] found that only eight of sixty-five strains (mainly intestinal) fermented dextrin, although his data for raffinose and sucrose accord more closely with the results of McIntosh and his collaborators. Cannon finally established his types on the basis of Rahe's scheme. Rahe[24] studied thirty-eight strains of *B. acid-*

24. Rahe, A.: Classification of Aciduric Bacteria, J. Bacteriol., 3: 407 (July) 1918.

*ophilus* from various sources including saliva, feces, milk, sewage and cases of carcinoma. These he separated on the basis of fermentation of maltose, glucose, lactose, sucrose and raffinose. The strains fell into four groups, which he called A (twenty-four strains), B (eleven), C (two) and D (one). These are shown in Table 1.

From Rahe's full tabulation of results, it does not appear that there is any correlation between type and source; and so far as his strains from saliva are concerned, some or one of them fell into all of his groups with the exception of his Group C. Indeed, his single member of Group D came from saliva. If we compare Rahe's results with those of McIntosh and his collaborators, a difference in raffinose fermentation is seen to exist. Of seventeen strains from saliva, Rahe found that twelve fermented this sugar, while it was concluded by McIntosh and his co-workers that strains from the mouth differed from intestinal strains in being raffinose-negative. In a similar way, although the latter investigators showed that only 32 per cent of their mouth strains were sucrose-positive, Rahe found that 94 per cent of saliva cultures fermented sucrose. The data of Rahe and of McIntosh and his collaborators on the action of saliva or mouth strains of *B. acidophilus* on raffinose and sucrose are therefore mutually contradictory.

In summarizing the results of other workers, there seems to be no agreement such as leads to a clear-cut differentiation into types on the basis of biochemical reactions. The contradictory results in fermentation tests on acidophilus from different sources is observed in no less degree in strains coming from saliva or from carious teeth than from other sources. The nearest approach to a separation into types on biochemical grounds has been attained by Rahe; but it is also clear that his C and D types possess little significance in view of the small number of strains studied. Therefore, a satisfactory differentiation of *B. acidophilus* on the basis of biochemical differences is at present far from being attained.

TABLE 1.—RAHE'S CLASSIFICATION OF B. ACIDOPHILUS

| Type | Maltose | Glucose | Lactose | Sucrose | Raffinose |
|---|---|---|---|---|---|
| A | + | + | + | + | + |
| B | + | + | + | + | − |
| C | + | + | − | + | − |
| D | + | + | − | − | − |

Although we are unable to advance materially the solution of this problem, we believe a clearer understanding can come only through the accumulation of similar data; and, with this in view, our own results on a study of thirty-one strains of acidophilus from teeth are presented. Of these strains, six were tested on fourteen sugars, and twenty-five on five sugars. The method used involved the inoculation from slant agar into broth of *p*H 6.6, containing 0.5 per cent of the sugar. After incubation at 37 C for seven days, the H-ion concentration was determined colorimetrically by adding one or another indicator solution to the whole tube, after the range of reaction had been roughly ascertained by a preliminary test using

the drop method. Any *p*H at or below 5.2 was considered positive.

The twenty-five strains were tested on the five sugars used by Rahe, and the results are shown in Table 2.

It appears from these data that, of the twenty-five strains studied, seventeen fall into Rahe's types, while eight give different fermentation reactions. In the table as a whole, the most significant points are: (1) that all strains fermented glucose; (2) that only one fermented raffinose; (3) that only three were sucrose-negative and three lactose-negative; (4) that seven were maltose-negative. With respect to raffinose, the results agree with those of McIntosh and his collaborators. With respect to sucrose, we found only 12 per cent negative as compared with their 68 per cent. With respect to lactose, we found 12 per cent negative, while they report 14 per cent, a closer agreement.

One important divergence in these results is the finding of seven of twenty-five strains maltose-negative. This suggests that the fermentation of maltose cannot be taken as a point of differentiation between *B. acidophilus* and *B. bulgaricus*, as suggested by Rahe. It will be recalled that this method of differentiation is also vitiated by the observations of Kulp and Rettger,[19] who found certain of the bulgaricus strains maltose-positive.

All of our strains, except the three that were lactose-negative, curdled milk in from eighteen hours to twelve days, the time required for the majority of them being from two to three days. The lactose-negative strains had no effect on milk in thirty days.

In order to ascertain whether strains of acidophilus from carious mouths showed fermentation characteristics unlike those from noncarious mouths, a comparison was made, with the results observed in Table 3, showing the reactions in a series of fourteen carbohydrates and in milk. The medium in these tests was infusion broth of *p*H 6.6 to which 0.5 per cent of the sugar was added. The final reaction, after incubating for seven days, varied around *p*H 4.3, the minimum being 3.4. No differences were observed in the behavior of these groups in any of the sugars. All strains of both groups were negative in xylose, raffinose and starch. All were positive in glucose, levulose, galactose and sucrose. In other sugars, there was some variability, but in no

TABLE 2.—CLASSIFICATION OF B. ACIDOPHILUS FROM CARIES ACCORDING TO RAHE'S SCHEME

| Rahe's Types | Maltrose | Glucose | Lactose | Sucrose | Raffinose | No. of Strains |
|---|---|---|---|---|---|---|
| A | + | + | + | + | + | 1 |
| B | + | + | + | + | — | 13 |
| C | + | + | — | + | — | 3 |
| D | + | + | — | — | — | 0 |
| * | + | + | + | — | — | 1 |
| * | — | + | + | + | — | 5 |
| * | — | + | + | — | — | 2 |

*New types appearing in these tests.

sugar were all the strains from one group negative if any strain from the other group was positive, and vice versa. If the table is analyzed, a slight difference between the strains from the two sources appears. In the three strains from carious mouths tested against fourteen different sugars, there were obviously forty-two chances for fermentation, and the same was true for the strains from noncarious mouths. In the former instance, twenty-seven tubes were positive; in the latter case, only twenty-two. Whether this difference is of significance cannot be decided until a greater number of strains have been studied. When the degrees of acid production in the tubes that were positive were compared in the two groups, the average amount of acid formed, for all sugars that were fermented, was found to be identical, both being *p*H 4.3.

In connection with the final degree of acidity formed in 1 per cent glucose broth by twenty-five strains, it may be mentioned here that the lowest acidity observed was *p*H 3.4 at the end of seven days' growth, the majority of cultures being from 3.6 to 3.8. Titrations were made colorimetrically, according to the method of Clark and Lubs.

No gas was formed in glucose broth by any of these strains, and none formed indol in either plain or tryptophan broth.

From the foregoing results dealing with the sugar fermentation, as also from the differences between our own work and that of the preceding investigators, it is apparent that there are, as yet, no justifiable or satisfactory grounds for dividing into types strains of *B. acidophilus* coming from the teeth. Our experiments on strains from noncarious and from carious mouths are too few in number to warrant any conclusions on possible differences in strains from these sources. What data we do possess show them to be similar in all morphologic and biochemical features.

*Conclusion.*—We may emphasize our belief that, in view of the close morphologic and biochemical similarity between strains of *B. acidophilus* from teeth and strains from other sources, there is little justification in establishing an independent bacterial species or subspecies to include these organisms. We, therefore, prefer to adhere to the original name given by Moro, *Bacillus acidophilus;* at least until further systematic study may place these bacteria in one of the groups of branching organisms, where they undoubtedly belong.

TABLE 3.—A COMPARISON OF STRAINS FROM CARIOUS AND NONCARIOUS MOUTHS

| Source | Strain No. | Glucose | Levulose | Galactose | Arabinose | Xylose | Rhamnose | Maltose | Lactose | Sucrose | Raffinose | Dextrin | Starch | Dulcite | Salicin | Milk |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 37 | + | + | + | − | − | + | + | + | + | − | − | − | + | + | ac-cl |
| Carious Mouths | 49 | + | + | + | + | − | + | + | + | + | − | + | − | + | + | ac-cl |
| | 58 | + | + | + | − | − | − | + | + | + | − | − | − | − | + | ac-cl |
| Non-Carious Mouths | 15 | + | + | + | + | − | − | + | − | + | − | − | − | − | − | − |
| | 16 | + | + | + | − | − | + | − | + | + | − | − | − | + | + | ac-cl |
| | 50 | + | + | + | − | − | − | + | + | + | − | + | − | − | + | ac-cl |

### V. AN ATTEMPT TO CONTROL CARIES BY THE INHIBITION OF THE GROWTH OF B. ACIDOPHILUS IN THE ORAL FLORA

If the presence and characteristic function of *B. acidophilus* is found to exercise a major influence in the process of dental caries, the control of such bacterial overgrowth should have a decided effect on the limitation of that dental disease. The factors that make for the overgrowth of *B. acidophilus* in certain mouths may be of two types: (1) a specific type of organism of high potential activity; and (2) the environmental conditions that favor or hinder the growth of this type of organism. That the virulence of an acidophilus strain is not alone responsible for the overgrowths of that organism in certain mouths is evidenced by the fact that such strains apparently are not transmitted by contiguity. It is more reasonable to believe that the manner of growth of this organism is determined by the environmental conditions present in the mouth; i.e., the character of the saliva; the nature of the retained foodstuffs, and the symbiotic relationships with other organisms in the mouth flora. An illustration in point is that of the young woman who for several weeks drank a quart of acidophilus milk daily, as related in Section I.

The more we study the problem of dental caries and the significance of the bacterial flora as a causative factor in the process, the more it becomes apparent that acute caries of the teeth is in many respects similar to acute pyorrhea and acute stomatitis, differing from these conditions only in the type of organism which is predominant at the time. In acute pyorrhea, proteolytic and putrifactive organisms predominate; in Vincent's infection and acute stomatitis, the fusiform bacillus and the attendant spirochaeta are most in evidence; while in acute caries the presence of aciduric types of organisms, notably B. *acidophilus*, is the outstanding bacteriologic characteristic. In each case, the organisms concerned are common inhabitants of the mouth, but under certain conditions the oral environment favors the active proliferation of one particular type of organism over that of the other types, as a result of which characteristic pathologic effects are produced. It has occurred to us that, as acute pyorrhea and acute stomatitis may be overcome and controlled by simple hygienic and bactericidal measures that tend to decrease the overgrowth of the specific organism and to establish a different form of mouth flora, the process of acute caries also might be controlled as effectually as other oral infective processes.

Attempts have previously been made by many observers to eradicate the acid-forming type of organisms in cases of active caries. These attempts have been along three general lines: (1) by planting in the mouth proteolytic types of organisms that might overgrow the prevailing acid-formers, thus establishing an alkaline rather than an acid producing flora; (2) by a change of the salivary and buccal secretions through local stimulation or through the systemic effect of drugs and dietary control, in the attempt to produce a type of oral environment that is less favorable to the aciduric type of bacteria; and (3) by the employment of prophylactic methods and germicides to minimize all bacterial growth in the mouth, in the hope that subsequently a fixed type of bacterial flora will result in which the acid organisms will not prevail to the same extent as formerly.

Goadby[2], in 1910, reported that he had sowed the spores of *Bacillus mesentericus* and *Bacillus subtilis* in carious mouths to overcome existing high states of acid fermentation. He stated that, if the mouth was first given thorough prophylactic care and the spores planted about the teeth, these organisms would become established in the mouth and be maintained, provided the carbohydrates of the diet were decreased and proteins

were increased. He stated that, in this manner, he was able to establish a predominance of proteolytic organisms and a reduction of acid-forming types in the oral flora. Pickerill,[25] Gies[26] and others have suggested the use of acid mouth washes to stimulate a free flow of thin saliva. Pickerill[27] states that children who use a "fruit acid" mouth wash have a predominance of the mesentericus organisms in the mouth and freedom from dental caries.

Miller,[14] in his early work on dental caries, stated that an abundance of carbohydrates in the diet strongly favored the overgrowth of acid-forming organisms and increased acid fermentations in the mouth. For that reason, he favored the elimination from the diet of all carbohydrates that tended to remain adherent about the teeth after meals. Miller, further, attempted to control the activity of acid-forming organisms by oral prophylaxis and by the use of germicides. In this, he confessed failure to limit more than temporarily the growth of organisms, and states that "great difficulties lie in the fact that nearly all materials that possess antiseptic properties are either contraindicated in the mouth or they may be used only in very dilute solutions."

More recently, McIntosh, James and Lazarus-Barlow[11] reported that they had attempted to modify the acidophilus growths in the mouth by the use of various antiseptics. They, like Miller, were also disappointed in the result which they obtained, and they conclude that the "concentration of most disinfectants suitable for use in the mouth and necessary to kill the organism in five minutes is too great to be practicable." Thus, we see that the previous observations on the effect of diet and salivary stimulation has been largely speculative and that all attempts to limit the growth of organisms by the use of antiseptics has met with disappointment and failure.

By the following experiments, we have attempted to determine whether or not growth of *B. acidophilus* might be controlled by (1) the increase of acids or alkalis in the diet, (2) by administration of drugs and (3) by the employment of antiseptics. A group of patients were selected, all of whom showed evidence of active caries, whose mouths contained strong overgrowths of *B. acidophilus* and who could be relied on to carry out specific instructions.

1. A group of six of these patients were put on a diet in which acid foods and fruits were increased as far as possible. The individuals of this group followed this acid regimen for several weeks, during and at the end of which time, there was no apparent change in the growth of *B. acidophilus* in their mouths.

2. In a group of five cases, sodium bicarbonate, 5 grains, was administered, four times daily, during a period of from two to four weeks. While the alkali was being administered, the mouths and teeth of these patients were apparently cleaner, but masses of *B. acidophilus* were found to prevail in all protected areas about their teeth.

3. Two patients were instructed to rinse their mouths with milk of magnesia between meals and at bedtime. This treatment was continued over a period of four weeks without any apparent effect on the growth of *B. acidophilus.*

4. In one case, potassium iodid was administered in 5 grain doses, three times daily, for one month, to ascertain whether any change in oral conditions might be produced. This case was observed two months later, at which time recent lesions of caries were in evidence.

Having met with apparent failure in every attempt to control the overgrowth

25. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, New York, S. S. White Dental Mfg. Co., 1912.

26. Gies, W. J.: J. Allied Dent. Soc., 8: 283, 1913.

27. Pickerill, H. P.: A Sign of Immunity, Brit. Dent. J., 44: 967 (Sept. 1) 1923.

of *B. acidophilus* by indirect means, we then employed more direct measures of attack in the form of germicides and prophylactic procedures. Since the results of previous workers who have employed the commonly used antiseptics and germicides had been so unsatisfactory, we tested the action of several anilin dyes in their efficiency to destroy *B. acidophilus* under conditions found in the mouth. The dyes to which we gave our major attention were neutral acriflavin, mercurochrome, and a combination of brilliant green and crystal violet. As these dyes are known to be highly germicidal in action and are seemingly harmless to the body tissues, it seemed possible that they might be of service in the control of oral organisms.

In each case, dilutions of 1:100 and 1:1,000 were made, and these solutions were inoculated from a broth culture of *B. acidophilus*. The organisms were left in contact with the dye for one minute, at which time a subculture was made into glucose broth. It was found that all three of the dyes killed *B. acidophilus* at a dilution of 1:100 in one minute. In dilutions of 1:1,000, acriflavin showed no germicidal effect; while mercurochrome inhibited the growth, and brilliant green-crystal violet was strongly germicidal. Accordingly, a 1 per cent solution of brilliant green-crystal violet was used as the antiseptic agent in our tests.

5. A large group of carious individuals were treated with brilliant green-crystal violet in the following manner. All surfaces of the tooth, as well as the gums and the buccal mucosa were painted with the solution. After the dye had remained on the teeth from one to five minutes, it was removed by engine-driven polishing devices, special attention being given to those areas in which a stain was evidently resident in a localized plaque. This procedure was repeated each day for one week, during which the patient was taught how to brush the teeth and properly care for them. At the completion of the week's treatment, specimens from the mouth were examined for *B. acidophilus,* and the patient was asked to return one week later, in order that we might note the clinical appearance of the mouth and obtain bacterial cultures.

The results obtained by this procedure in many cases of marked caries were most striking. In many instances, the teeth were previously unclean in appearance, being habitually covered with a slimy coating of mucinous-like material that, on examination, revealed large numbers of *B. acidophilus.* This slimy coating on the teeth promptly returned within a few days after a thorough prophylactic treatment. In many such cases, following the dye treatment, the mouths underwent a marked change in clinical appearance in that the habitual slimy deposits disappeared and, even several months after the treatment, did not reappear. As a rule, there was a marked decrease in the entire bacterial flora and notably in the *B. acidophilus;* while, in several instances, we were unable to discover by cultural methods any acid-forming organisms, even though we took several samples from protected places about the teeth. Among the cases so treated, two showed most striking results and deserve special mention.

A brother and sister, ages 9 and 10 years, respectively, were suffering from a most unusual amount of advanced and rapid caries; many of their teeth had been filled, and there were many recurrent and new lesions of caries. The teeth of both children were habitually covered with a slimy deposit especially on certain protected places on the buccal and interproximal surfaces, at which point active destruction of the tooth by caries was taking place. This deposit, when removed by prophylactic measures, would recur and be reestablished as prominent masses of white, soft material within a few days. Repeated bacteri-

ologic examinations of this deposit showed that it was constantly loaded with *B. acidophilus,* and, in many localities, this organism was growing in almost pure culture.

Our first treatment of these children was to fill the open cavities, to clean their teeth thoroughly and to teach the patients how to care for their mouths properly. The girl was given a course of stomacic medication of sodium bicarbonate, and the boy a similar course of calcium phosphate extending over a period of six weeks. Both children during this time used milk of magnesia as a mouth wash. At the end of the treatment, no apparent benefit could be discerned in the cleanliness of the mouth, nor in the relative overgrowth of *B. acidophilus.* If allowed to go without prophylactic interference, the teeth within one week would be covered with heavy deposits of soft, slimy material, heavily laden with *B. acidophilus.*

Both children were then given a course of treatment with brilliant green-crystal violet dye for ten days, at the end of which time the teeth appeared much cleaner, and the former slimy coating had disappeared. Smears and cultures taken from the protected places about the teeth showed a decrease of *B. acidophilus,* and, in the case of the boy, repeated examinations were made in which no *B. acidophilus* could be demonstrated. When observed two months later, the mouths of both children were clean, and there was no evidence of slimy deposits on or about the teeth, although, during the time that had elapsed, no attention had been given to their mouths other than the personal care that the patients gave them with brush and dentifrice alone.

From the limited number of cases treated and the short period of observation, no definite conclusions as yet may be drawn relative to the efficiency of this method to control caries; but the manifest change in the clinical appearance of cases under treatment and the apparent diminution of acidophilus growths are sufficiently promising to warrant a further study of the use of anilin dyes in caries control. It would be most gratifying to us if other students of this subject, and general practitioners of dentistry as well, would clinically test this method, or reasonable alterations of this method, on a large group of selected cases that could be watched over a period of years, with a view to determining its usefulness as a means of preventing caries.

## CONCLUSIONS

1. *B. acidophilus* is present in every initial lesion of dental caries. It is also the inhabitant of a small percentage of mouths in which there is no dental caries.

2. Strains of *B. acidophilus* taken from the mouth, when the organisms are growing under optimum conditions and when their products are confined to a small area on the tooth, may produce definite caries-like lesions in from six to eight days.

3. Strains of *B. acidophilus* associated with dental caries are highly pleomorphic, and morphologically and biochemically are similar to strains isolated from the intestines by Moro and others. At the present time, we see no justification for giving this organism a new name; nor do we find satisfactory grounds for grouping strains into various types on the basis of morphology and fermentation tests.

4. The results of our experimentations support the view that overgrowths of *B. acidophilus* in the mouth may be controlled by the use of anilin dyes, and that this procedure may be of value in the control of dental caries.

## DISCUSSION

*T. B. Buest, Louisville, Ky.:* I feel that there has been no relation shown between *Bacillus acidophilus* and caries, for the simple reason that teeth do not decay in the manner shown on the screen. In incipient caries in the mouth, we have advancement of decay through the enamel by degrees; at first a

small area, followed by gradual penetration, until finally the dentin is reached. In Dr. Bunting's presentation, we have seen layer after layer of the tissue removed. In caries in the mouth, we find that the tooth does not decay in this manner, for here the acid in its advancement toward the dentin leaves the enamel intact. The form of the enamel rods, the matrix, if you will, remains complete until almost all of the enamel has been traversed by the agencies that are attacking the tooth. The fact that the matrix of the enamel remains intact may contribute to Dr. Larson's view that caries occurs in an alkaline medium through the direct action of ferments. W. D. Miller has already stated that the rods remained intact until caries had made considerable progress. If you take a tooth with incipient caries that as yet exhibits no break in surface continuity, and immerse it in lactic acid, you will be surprised to find that the sound enamel will be decalcified and the decayed part remain. That can be verified very easily by taking any tooth with incipient caries and exposing it, we will say, to a 3 per cent solution of lactic acid. The decayed part will remain prominent, will retain its matrix. The sound tissue will be removed, leaving the decayed part as a pillow. Sodium hypochlorite and probably other alkalis will dissolve this. As we know relatively little about the constituents of the enamel, we are as yet unable to say whether the agency is an acid or an alkali.

*Dr. Bunting:* I am free to admit, as I did before, that these conditions that I have shown you are not true caries because the acids are much stronger than we had in the mouth. We are going to experiment with a smaller amount of acid. Let me ask you again, as I want to be perfectly certain: You quoted Miller as having performed this experiment. Are you quite certain now that this was enamel or dentin he was talking about? I have seen his experiments on dentin in which the section of dentin is shown, but I have never seen his reference to this.

*Dr. Buest:* The experiment is my own. I quoted Miller as having said the matrix of the rod is retained. This experiment on lactic acid is my own.

*Dr. Bunting:* Have you not seen other forms of caries in which it seems that the enamel has gone out in a mass, as if the action had been much more rapid, and when you cut sections of the tooth you found that portions were taken out and the dentin had not been reached yet? I had in our laboratory two sections, made by Dr. Miller, of beginning caries on teeth on plates, and they appear almost identical with the specimens I have shown you today. If I could only find a number of instances of caries produced on teeth that were devoid of pulps, then, I think, I could come closer to producing that kind of caries.

I am free to admit that these are not typical lesions of caries, but I think they are quite like those that occur on teeth that are devoid of pulps. The fact is, the organisms are on the spot and they are able to produce any quantity of acid necessary to caries if they but have the opportunity. The fact that acid-forming organisms are invariably present is circumstantial evidence, at least, pointing to the possibility that they have something to do with the case. I shall endeavor to duplicate the experiments of Dr. Buest.

*Dr. Buest:* I have no doubt that Dr. Bunting will succeed in creating this condition by reducing the strength of the acid. I am quite sure that is possible, because I have been making experiments along those lines recently in connection with mottled enamel.

*Dr. Bunting:* Do you get the typical streaking, such as occurs in the mouth?

*Dr. Buest:* You will get the mode of penetration, if that is what you mean. I have some in my collection. If we can get a microscope, we will consider it further. I have no doubt you will succeed by reducing the strength of the acid. But still we have to consider the presence of these phenomena before we can draw conclusions from an experimental duplication of it. That is the point I wanted to bring out.

*Dr. Bunting:* I am glad to know about that.

*Dr. Buest:* I would like to hear from Dr. Larson as to whether alkali would allow a portion of the enamel matrix to remain.

*W. P. Larson, Minneapolis, Minn.:* I am not sure that I can answer the question. I know that if you put a tooth in over 20 per cent sodium oxid, you will get erosions of the enameled surface. How deep they go and the histologic construction, I do not know.

*Percy R. Howe, Boston, Mass.:* Dr. Bunting's report is most interesting. He shows a type of bacteria about which there has been a great deal of discussion and he also has shown effects that he believes to be caries. From my studies of acidophilus as found in the mouth, I should perhaps differ as to classification, for I see forms here that I have thought belonged to another but similar micro-organism. However, that is of but little importance, for the group is aciduric in character, which is the main thing.

As regards the production of caries in animals, I will say that I have never seen effects on the teeth of animals produced by these micro-organisms that I considered to be

caries. Dr. Buest has diagramatically shown how caries progresses in human teeth.

The work of James, McIntosh and Lazarus-Barlow is in agreement with mine when they state that they were unable to produce caries in rabbits or monkeys by means of acidophilus. I have succeeded in producing caries in monkeys, but only by feeding various deficient or unbalanced diets. That primitive races or those living on natural foods are practically caries free, although they have never cleaned their teeth, is a matter to have in mind in considering the causative factor in caries.

Why it is that in the face of the bacterial life in caries the process is often halted and a hard calcific deposit occurs is another thought. The caries of pregnancy or of extreme old age are not to be attributed to sugar excess nor the flora that this is supposed to induce.

Why does caries cease with death? Eastern people living to a considerable extent on soured milks, which contain aciduric bacteria, not only have no caries but most excellent teeth.

On the whole, while Dr. Bunting is engaged in a most interesting field of work, I believe that we must look further back for the cause of caries. From my own work, I regard the bacterial flora of secondary importance, and I believe that caries is the result of physiologic changes.

*Dr. Bunting, (closing):* I hope that it is perfectly clear to everybody that we do not claim to have discovered the solution of the problem of dental caries, but we have found certain factors in the process that are interesting and that seem to be quite important; namely, certain bacteriologic factors and the influences that determine bacterial overgrowth. It appears that the environment has a great deal to do with the overgrowth. Everything that Dr. Howe has brought up this afternoon that would keep him from concurring with our views, are perfectly explainable to me on the grounds of metabolism, secretion and oral environment. Let me say this: If the time ever comes, when we can build a race that is uniform, like the milk drinkers, whenever we can have a uniform type of people in this country, perhaps we will learn how to feed them; but when we consider the variety of people that comprise the American population and the variety of underlying basic inheritances that come to each individual, I fear the time is a long way off when we will know how to reach all people with any particular type of diet that will meet their needs. We must study the diet as it relates to the general health and to the health of the mouth. I believe when we know how to prevent rickets we are going to know how to make better teeth, and those teeth are going to be in an environment that will be less liable to dental disease.

I am asking this: Isn't there enough evidence that *Bacillus acidophilus* might have something to do with caries, to warrant at least a trial of the antiseptic dyes on a few specific cases to find out if this infection is similar to Vincent's infection and may be similarly controlled? Do you refuse to treat a case of Vincent's infection before you know what change has taken place in the patient's health or what deficiencies exist in the diet that made the infection possible? No, you treat it directly. I am asking you to treat caries infections directly. Keep a record and carry the cases over a long period of time, and see if you have actually been able to control some of the cases that, previous to this time, you were unable to control.

I hope that I have made myself perfectly clear. We are not claiming anything. We are only asking for cooperation in the practical application of research data.

# DENTAL ETHICS

By H. B. CHILD, D.M.D., Grandview, Washington

(Read before the Yakima Valley Dental Society, Yakima, Washington, May 3, 1924)

IN attempting to investigate all of the phases of a subject so apparently simple and sterile as dental ethics, I have reached the conclusion that the material of any investigation could be adequately collaborated and the resultant thought wisely edited only by the discerning mind and facile pen of some eminent psychologist and after many months of effort. The reward would then be a major-sized volume, fit to take a foremost rank among dental textbooks; and it would be the first book of its kind where just such a book is needed today.

One of the chief thoughts of significance that must be emphasized is that there is a need and a reward for extensive study and research in the field of dental ethics.

Another impressive object lesson on beginning the investigation of the subject of dental ethics is that one experiences a deeper consciousness of the dignity of dental service and thereby becomes more keenly alive to his professional responsibilities. He is aware of his fellowship in service, called by one language *esprit de corp* and another *Zeit geist,* or literally the spirit of the hive. A study of Maeterlinck's classic "The Life of the Bee" is very pleasant and profitable reading in the field of ethics.

Surely professional practitioners ought to aspire to a serious class of desultory reading in addition to study; and if a fairly good amount is from the philosophies and philosophical essayists, inspiration and aspiration will accrue to ethical professional character.

The very foundation of professional integrity is an ever-conscious regard for its code of honor or ethics.

As dentists, we are foresworn to a deeply serious life work surrounded by obligations peculiar to that service, which are quite justified by the dignity and esteem bestowed on us in our professional capacity.

The public has said to us that we are the only class to which has been given the entire charge of all dental service; that, in delegating this responsibility to us, it has left itself no measure or conception of our highly technical knowledge; and it has put us on honor not to betray its confidence. But it has not based this confidence on transgressions on public rights. It has said to us simply, "Do right;" and we as a body have established and must continue to establish the rules of professional rectitude.

Our code of dental ethics is the Bible of dentistry. It is at once a history of our accomplishments, and an epic of the evolution and expansion of dental service, the psalm of our professional pride and dignity, a creed explaining our own sense of obligation, and the Mosaic Law of our conduct toward our own fellows and the people at large.

The most significant deduction from my investigation of this subject relates to the failure of dentistry, and particu-

larly the dental colleges, to make use of the opportunity to establish the precepts of dental ethics in the student years.

Surely, the personal consideration for dental obligation and dental ethics should be awakened at once when one enters the dental profession; and the first and chief place for any textbook and teaching on dental ethics should be in the first year of training. The student has taken the first step into our guild. His mind is supple and open to impressions and to inspiration. He is usually not then moved by any pecuniary considerations. It is here, while observing the other formalities of his initiate, that his character may the more readily be imbued with the spirit of dental altruism.

Just as truly as we believe in ethical practice, so truly must we condemn unethical practice as we would charlatanism and quackery. Demonstrated: That we have a contention with those who belittle the dignified obligations of dentistry with their selfish and profiteering standards; that the contention is not concerned so much with personalities as with principles; that a breach has been opened within the profession, which is a matter for regret; that the dentist who resorts to unethical practice is seldom regenerate and that the resulting separation between ethical and unethical dentistry continues without amelioration. It would then seem that ethical dentistry is largely at fault when it wastes the golden opportunity of four potent years of labor to establish itself.

That would seem to be one large problem in itself—the conviction of ethical values to the student. But, since the law of averages is absolute, and there will always be the unregenerate few, the method of converting the unethical dentist in practice becomes the other large problem and one which ethical dentistry ought to attack with a larger earnestness than is being given to it. In such a worth-while undertaking it would seem that organized ethical dentistry could afford to create organized action led by the efforts of efficient, enthused and especially trained men.

If we feel that the profession of dentistry is made to suffer disparagement by the dishonest perversion of dental service through the cupidity of a relative few, then it would seem that dentistry has failed to face a serious issue.

Unless ethical instruction passes into ethical action, it is worse than useless. When one has intentionally left any correct principle of action, he will then accumulate arguments to justify himself.

What is expressed in the word ethics? It is derived from the Greek, which means: "That which pertains to character."

From the dawn of written history, ethics has been evolved and great minds have labored to teach it.

Buddhism, Confucianism, Judaism, Mohammedanism, the Greek and Roman philosophies, Christianity and the medieval and modern philosophies—all have the same scope. Within the light of their eras, they translate their knowledge and intuition into rules of rectitude for human conduct.

Ethics, in the widest sense, would imply an examination into the general character or habits of mankind. As this overlaps many fields of thought, such as history, anthropology, physiology, biology, and psychology, ethics is usually confined to that particular field of human character and conduct relative to certain general principles known as moral principles.

Men in general characterize all conduct as good or bad, right or wrong, and it is the meaning and scope of these adjectives, principally in relation to human conduct and finally in their complete sense, that ethics investigates.

Where ethics has been called the science of conduct, there is an apparent error, since a science is experimentally demonstrable and the field of ethics is but man's attempt to formulate a code based upon a philosophy, or a process of reflection on the moral consciousness.

Scientific laws are inflexible; whereas, the code of ethics, based upon man's conception of right, wrong, good and evil, is a flexible code to just the same degree that man's perception of his larger duty is subject to enlightenment.

Ethics does not deal directly with matter; only indirectly. But it does deal always and directly with man and his relation to society. It reasons through a sense of moral obligation to society, more through a mental process than an intuitive or inspired process such as creates a religion.

One of the first rules in ethics is to distinguish the true from the false. Religions have had their standards raised, full-formed at once, with the conception of the religion. It is the need to reconcile their standards through changing areas that creates the restlessness of religion's thinking adherents.

Since ethics is subjective to a mental process, it is flexible to the development of that process, yet satisfying because it compiles the best principles of rectitude of all the Ages.

It would therefore appear that study, comprehension and use of the rules of ethics, as developed by the world's great philosophers, would bring to mankind as adequate a measure of true happiness as do the different religions. It would be something to have a world condition free from the differences and fanaticisms of the separate religions, to say nothing of the bickerings of sects, denominations, creeds, etc.

Possibly, it can best be said of the religions that they satisfy the unschooled aspirations and emotions of the mass of humanity to the end of human happiness; which moral philosophy could attain only with that small minority of mankind who deeply cogitate and clearly perceive the moral issues.

Man has always considered the attainment of true happiness the goal of life. The aim of moral philosophy, through the intervention of a consciousness of ethics, is to create true happiness. Religions largely anticipate this reward for the spirit beyond the grave. Ethics teaches the reward to be a present living consciousness of rectitude, obligation and service.

To summarize: Ethics is the standard achieved, through reason, by moral philosophy; the following of which will lead to the attainment of true happiness.

Why has a profession a peculiar position, which distinguishes it from a business and a vocation; and why is there specialized professional ethics?

When men are banded together within one field of service, it is a natural human impulse to feel the competitive spirit. Competition is a stimulus to every form of effort created through the free play of individuality. Properly controlled, it is a mighty dynamic force for good. Uncontrolled, it ends in chaos.

Each form of service creates a field for competition within that service, but, for purposes of argument, competition does not arise between different forms of service nor between workers in different forms of service. By forms of service, I mean all specialized business, vocations and professions.

Hence, the competitive attitude is admitted to exist within the ranks of a profession, and the problem thereby created is a restricted and specialized one to be controlled from within the ranks of professional life; and even, more particularly within the ranks of the specialized professions.

As has been said, "a profession has

a certain attitude acceded to it by the people from time immemorial and investing it with dignity befitting its altruistic service." This elevation has created certain licensed prerogatives, obligations and immunities.

A profession is distinguished from a business by the fact that it requires technical knowledge that can be acquired only by extended study by persons who have an aptitude therefore. The professional man is apt to be of a more pronounced intellectual disposition and capable of a keener interest in problems for their own sake than the business man, who, lacking the purely intellectual interest, is more apt to be moved by the profit-seeking motive.

A vocation is denied professional recognition because its requirements in training are less than those of a profession.

Professional men consider themselves to be distinguished among the world's workers by their greater freedom; by their primary interest in problems and their comparatively disinterested attitude; by their possession of specialized knowledge, and by a high sense of moral obligation. The professional man does not work for pay primarily and has only one grade of work, namely, his best. He sells a mental product that is identified with himself, which is a sufficient justification for professional pride. The personal nature of professional service interferes with an inclination to profiteer.

Because professional men are dependent on their knowledge and skill, they are as nearly independent as workers can be. This freedom imposes obligations on them individually that do not rest on one in business, where responsibility is divided.

Because of the freedom of professional men, the professions have felt the necessity of controlling socially inexpedient behavior of their members; and our national professional associations have set forth standards of high class practice in their constitutions and by-laws and in codes of professional ethics.

The public is dependent for the efficient service of professional men on this sense of ethical obligation. Patients cannot judge the worth of professional service, since that involves the possession of highly technical knowledge. When the patient's deepest interests are involved, he should commit them only to professional men whom he has grounds to believe are worthy of trust. Therefore, there is need that callings of this confidential character be restricted to men of honor, acting with reference to a high standard.

Another reason why a high standard of professional ethics is imperative is that professional behavior cannot be carefully regulated. Professional services can be adulterated with impunity unless there is a vital sense of ethical obligation.

Within the ranks of a profession, however, inefficiency cannot be camouflaged to any degree; and if the layman delegates specialized ability to a profession, then the members are in duty bound to expose any of its own incapability. It is as much a digression from ethical standards inwardly to condemn and not openly expose unethical practice as it is to resort to it oneself.

Surely, if one believes in ethical standards, he must do so with a militant spirit; and yet the history of dentistry has never shown any serious or worthwhile opposition—surely no widely organized fighting spirit against the unethical methods of so many members.

Within the profession of dentistry, the problem would appear to be easily resolved into one clean-cut line of action against unethical practice, for the reason that virtually all unethical practice adopts the same methods. Any ground for action by ethical dentistry would involve, first of all, an attack on the

methods of the so-called "advertising," "contract," or "dental parlor" group. A proper sense of our ethical standards will justify militant opposition to the methods of this group, and thereby present a more reasonable cause when methods, rather than individuals, are alined against each other. If dentistry is ever going to end unethical practice, it will win practically the entire fight upon this ground. The rest would be only a matter of cleaning up the trenches and snipers—men masking as ethical when they are not so in fact.

I have purposely refrained from involving this paper with the details of this phase of the subject. The aim has been to keep the subject upon broader ground.

One thought has suggested itself often: when a force has gained so much ground as has been gained through the common methods of this unethical group, it might be beneficial to determine whether any of these methods could be the pith of something usable in ethical practice.

Though the professions, and particularly medicine, of which dentistry is a component profession in its relation to disease and health, are motivated largely by altruistic tendencies, nevertheless the members in organization have seen fit to compile their ethical standards and attempt to encourage the members to comply with them. If every member had conceded these standards and had had the courage to maintain them, there would have been no need for such action. The test of the entire reasonableness of the code of dental ethics might be said to involve their legal compulsion on all dental practitioners. That would be the broadest ground to take in attempting more ethical observance. It involves, however, a very abstruse question of constitutional rights.

Leaving any question of legal compulsion aside, the ethical practitioner has sufficient grounds to condemn the unethical practitioner, and to denounce his conduct as pernicious to the ideals of the profession and to the welfare of the public.

The inception, progress and achievement of all ethical dentistry has its inseparable relationship to organization.

Unethical dentistry derives everything from the benefits of such organization and yet contributes nothing thereto. Such a condition would be considered insufferable and intolerable if we but had the authority to correct it.

Through organization, ethical dentistry has established its code. The American Dental Association adopted its code in 1914, and the Washington State Dental Association incorporated a code in its constitution and by-laws. These codes set forth the aims and objects of the associations, and unethical dentistry does not subscribe to any of these aims and objects. In some associations, the unethical practitioners transgress actively; in others, passively.

Since the object of every aim is to benefit dentistry by widening its service to humanity, then unethical dentistry may well be said to prey on the two sources of its being, the people who patronize it and the elements in dentistry that contribute to its professional ability. For unethical dentistry to be at variance with ethical associations is for it to be at variance with all of the objects of such association. Therefore, it is well to examine some of the principal objects in order to show how far unethical dentists fail in their performance of professional duty.

Associations, in their codes of ethics, set forth such aims as these:

To hold meetings for discussion of dental problems.

To publish information which shall promote the efficiency of dentists and enlighten the public.

To encourage cordial intercourse among dentists.

To raise the standard of, and improve the effectiveness of, the education of dentists.

To recognize eminence and unselfish capacity, and inspire research and original effort.

To prescribe such standards of behavior as shall foster high-class practice, protect the honor of the profession and promote its usefulness.

To promote the cooperation of dentistry throughout the world, and with other professions and vocational groups.

To inculcate in dentists the desire to develop or keep abreast with advancement in knowledge and skill.

To winnow right from wrong technical procedure.

It is an entertaining puzzle to attempt to find any point of contact between unethical practice and such high aims.

The code of ethics of each profession implies that its members are expected to have a "professional spirit" that distinguishes them as professional men, from other men. Essential in this spirit is the sense of the distinction enjoyed by an individual, on account of his membership in a profession, and of a responsibility to live according to its code of behavior formulated or implied. The rivalrous or competitive disposition is satisfied by the superiority incidental to membership in a profession and is annoyed by behavior of members that impairs its superiority in the eyes of the public. There are instances however, in which the men may secretly engage in disreputable or unethical behavior; yet strongly condemn such behavior in others. There are men with these contrary motives. They have the impulse to be proud of a membership in an approved group; and they have impulses to act secretly contrary to the standards of that group.

Fortunately, the profession of dentistry is fairly free of men of such type, of whom many more examples may be found within such professions as medicine and law. However, that fact is scarcely a cause for self-approbation, since it may easily be seen that one not wishing to adopt approved ethical standards will be happier when openly allied with his fellows in the unethical group, especially since, in business life, that group has attained more or less of a common measure of recognition.

Dental ethics should always keep in mind the two dissimilar forces of professional rivalry and professional conservation. It should be the aim of our ethics to combat a too conservative attitude, as such an attitude is often opposed to the public welfare. Then there is danger of too conservative dentistry being combated by outside forces. We have seen how it might be possible for the issue of focal infections to be forced, on a too conservative attitude in dentistry, by the profession of medicine in consideration of public welfare.

Dental ethics should be jealous of changes on behalf of public welfare being forced by outside criticism.

Conservatism oftentimes spells rust, and so should be amenable to our ethics.

On the other hand, professional rivalry may lead to spectacular innovations of procedure, with unwarranted expectations from the public. This also is a matter for dental ethics jealously to guard against. The reaction casts too serious reflection on the integrity of the profession. Dental history has been too full of such cases.

The dental profession, in its code of ethics, formulates rules to restrain rivalry for the sake of efficient work and the welfare of the public. As the public are in most cases unable to estimate correctly the character of his operations, the dentist's own sense of right must guarantee faithfulness in his performance.

The code requires the dentist not to advertise conspicuously, not to claim superiority over rival practitioners and not to speak disparagingly of a rival. But codes of both the physician and the

dentist enjoin the practitioner to expose, without fear or favor, before the proper professional or legal tribunal, corrupt or dishonest behavior of a member of the profession.

This is rarely done in either profession. Nor do physicians or dentists frankly tell a patient of an injury or of poor work that has been done. The failure of practitioners to expose those who have done disreputable work is contrary to the public welfare.

However, in extenuation of this shortcoming, it must be considered that many patients would assign an ulterior motive to a conscientious doctor's or dentist's exposure of the disreputable work of another. Many patients would infer that he was criticizing a rival in his own interest, and would not take his criticism seriously. As a matter of fact, the prevailing practice is neither to disparage a rival nor to disclose the presence of poor work for the benefit of the patients. Doctors and dentists often seem oversolicitous to avoid appearances of professional jealousy, when they should cultivate a fine diplomacy to expose poor work in a manner that will create a desire for adequate service, at all times keeping procedure of operations in the foreground and the operator in the background.

When pecuniary advancement is the dominating spirit, it leads to rivalry in dentistry, as exemplified by the behavior of the unethical dentist, and tends to egoistic behavior, which is contrary to public welfare. The unethical dentist then works for money and a big practice, and does much poor work. The conscientious dentist does only good work; for the satisfaction both of his pride and of his sympathy for the patient.

No profession requires stronger conscientious impulses than dentistry, because of the comparatively small chance either of conscientious work being recognized by the patient or of poor work being found out.

Since we as dentists are impressed with the dignity conferred by the altruism of our professional standards, we may conclude that the measure of our individual success will be a satisfied conscience in maintaining these standards.

We may well put forth our best efforts to make them the inspiration of our character, to transmit them to the younger generations of dentists, and to combat every force which undermines the integrity of our profession.

An investigation of dental ethics has made me prophetic that a time will come when ethical dentistry will stop its guerilla warfare on undermining forces, and will unite with adequate leadership for broad decisive action.

# THE NECESSITY OF OCCLUSAL BALANCE IN PARTIAL DENTURE CONSTRUCTION

By G. E. CLEOPHAS, D.D.S., Beloit, Wisconsin

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

A PARTIAL denture is a removable substitute for one or more of the natural teeth in either arch, having a base plate resting upon and partially or wholly supported by the mucous tissues covering the bony structure of the dental arches.

The resistance to masticating stress being therefore divided between a resilient and compressible mucosa covering the ridges and the remaining teeth, we have a complex problem to solve in obtaining and maintaining an occlusal balance and proper distribution of stress.

Consequently, there is no field of restorative dentistry in which we are confronted with such a variety of unfavorable conditions as in the case of the mutilated arch which suggests a restoration with a partial denture.

It is the object of this paper and its supplementary clinic to present, without going into any special technic, the fundamental principles that should govern the construction of a partial denture, with special stress placed on occlusal balance.

Drs. Monson, Orton, Crawford and others have done original and exhaustive work which they have passed on to us along these lines. I wish also to show results obtained in some of my practical cases by following these principles.

The importance of occlusion is also so well recognized in periodontia and orthodontia that we can almost say it is the basis for all dentistry.

Only one who is well versed in the whole subject is adequately equipped to deal with the many individual variations, but a good technic in harmony with controlling or fundamental principles will result in success.

In cases in which we have abrasion of natural teeth, or some may have been lost for a period of time, we always have malocclusion and retrogressive changes. We must recognize here all the changes that threaten and the abnormal tendencies that have to be counteracted; for if we reproduce this condition with restorations, we are perpetuating the abnormal.

Some may argue that this present closed bite and changed occlusion is now normal to this individual. When we say normal occlusion, what do we mean by the word normal? If a person has been troubled with constipation for a period of time and he is beginning to feel and show the effects of the then ever-present toxins from a continued colon infection, would you call the bowel condition normal?

A good conservative definition of normal occlusion is: The nearest approach to the highest degree of development of the masticating apparatus that can be obtained for that individual. This, to

some extent, bars abnormalities that might have been corrected during the developmental period.

In this, as in medical science, to know the cause of the abnormalities and pathologic conditions will help us determine the treatment; but, to know the cause, one must be familiar with the physiologic function of all the muscles and

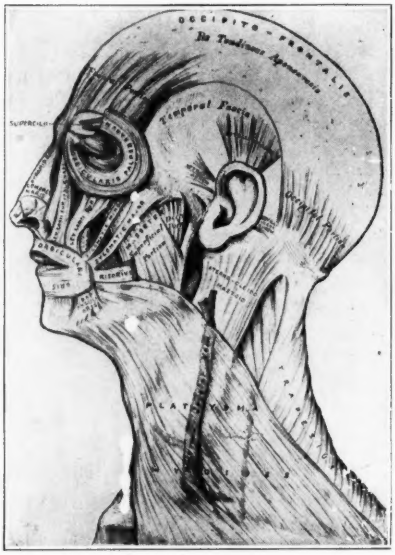


Fig. 1.—Superficial muscles of face and neck (Gray).

parts involved in the dental apparatus as well as the mechanics of occlusion, distribution of stress, lines of force, esthetics, etc. Or, simply stating it in another way, in supplying the lost parts with a partial denture, the restoration must never be regarded as a unit by itself, but as a part of the whole masticating apparatus. We are too prone to look into mouths needing restorative work of this nature and try to supply all that is lacking with our favorite type of restoration.

The statement made by Dr. Orton in a paper on bridgework also applies to partial denture work:

> If the problem were only to fill a gap in the arch or merely to obtain occlusal contact of the two arches in present central occlusion, the diagnosis would be a simple matter; but restorations with only this in view often do not justify the pain and expense necessary for the replacement.

By such procedure, we may only increase the abnormalities and attendant

Fig. 2.—Deeper tissues and vertical area (Gray).

pathologic condition, the advance of which may have made the partial denture necessary. Correct methods add to the life of the dentures and the individual.

In Figure 1, the superficial muscles of the face and neck (Gray), we readily see the necessity of reproducing anatomic relationship. The normal tone and tension of these muscles must be obtained by having or establishing a correct relation of the osseus framework.

In Figure 2, the deeper tissues and vertical area (Gray), we see the neces-

sity of having or creating the vertical area for the tongue and lingual tissues.

A shortening of this area must be remedied by a lengthening of the bite, and proper relationship restored. This relationship is entirely controlled by the temporomandibular articulation and the occlusal surfaces of the teeth.

In doing restorative work, we must also in aggravation of the pathologic condition and the facial distortion. Our object should be to correct the pathologic conditions and to overcome the appearance of senility, with accompanying lost facial dimensions in the lower third of the face, which is quite common to middle life or after and means abnormal relationship of the jaws.

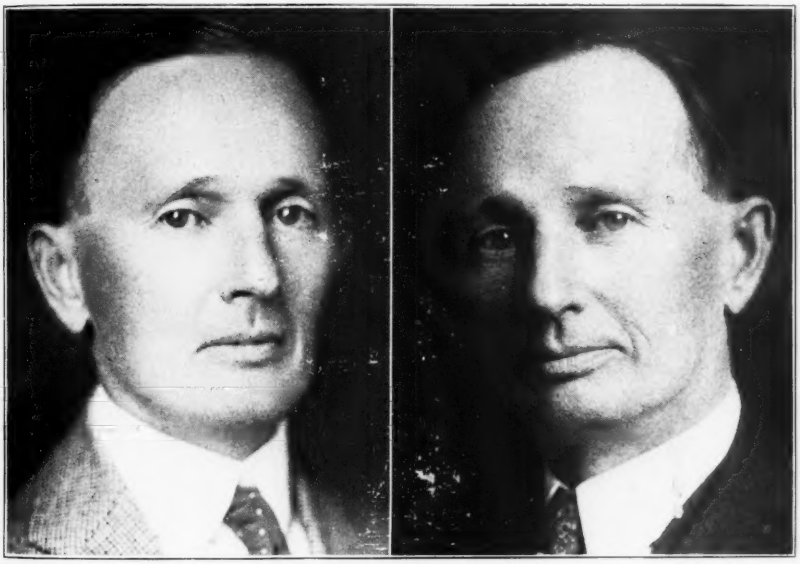

Fig. 3.—Left: Bite opened one-fourth inch; mandible advanced five thirty-seconds inch and occlusion balanced. Right: Shortened dimensions and abnormal relationship of mandible to maxillae.

recognize this relationship in its bearing on deglutition, oral drainage, condyle intrusion, lines of force, or traumatic occlusion, esthetics or facial dimensions, etc.; and, to emphasize what has been said before, a good technic in harmony with these controlling or fundamental principles results in success, but the most exacting technic out of harmony with these principles results in failure, and not only failure in the continued functioning of the appliance, but

Function creates or keeps the organ in health and pathologic processes or disturbed function is responsible for the organic lesion; so, to quote Dr. B. F. Lischer of St. Louis, "malocclusion always means abnormal function and invariably leads to structural lesions."

Figure 3 shows the importance of having an occlusal balance and the importance of other points touched on up to this time. We can here see at the right an abnormal relationship,

which usually involves the change shown here, a closure or shortening of the dimensions of the lower third of the face from loss or wear of the teeth, or both; for, as I have said, the temporomandibular articulation and the occlusal

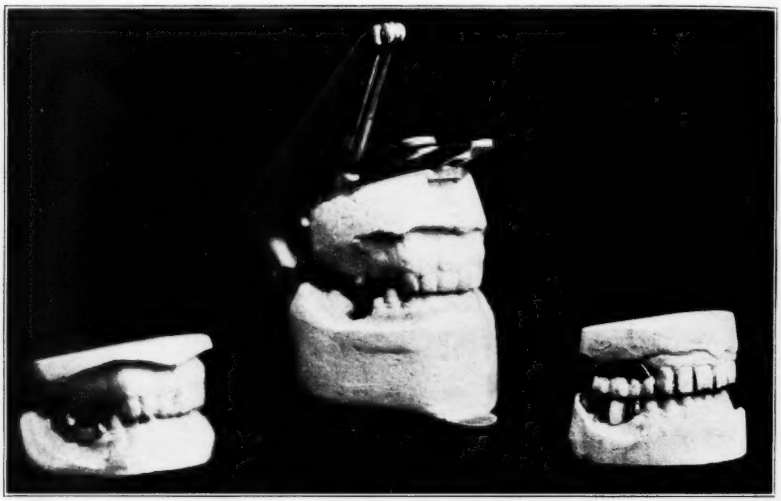

Fig. 4.—Left: Model of case as presented. Center and right: Models showing the bite opened three thirty-seconds inch and the mandible advanced one-eighth inch to a balanced occlusion.

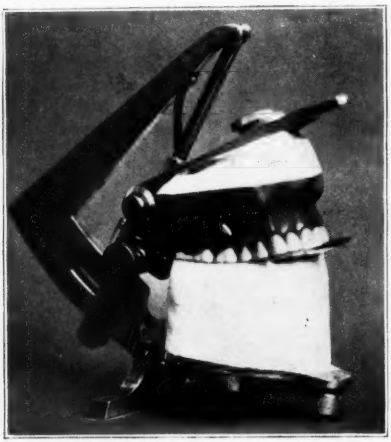

Fig. 5.—Balanced occlusion when the mucosa substitute under the artificial appliance is compressed 0.5 mm.

surfaces of the teeth maintain this relationship.

First, we see here a forcing up of the ala of the nose by the upper lip; a shortening of the upper lip with the forming of grooves and folds around it; the upward and advanced position of the chin and the full chops, which results from the shortening and lack of tone of the muscles, giving the appearance of early senility. Are we going to build to this condition and maintain this appearance? This in itself is a large subject.

Second, we have a crowding of the tongue space, as before mentioned, which causes a serious interference with oral drainage, or with swallowing, which is not done so often nor as it should be with the pressure of the two jaws in apposition and tensing of the throat

muscles. Instead, we have drooling at the corners of the mouth and lack of control of the oral secretions in speaking.

Third, there is interference with the eustachian tube in this closure of the bite.

Fourth, we have encroachment by the head of the condyle against the external meatus of the ear, causing, in some instances, the complete destruction of the interarticular fibrocartilage, which results in direct contact of the bony head of the condyle against the bony structures of the ear, causing irritation to the internal ear and often deafness. This is a subject to which an afternoon could be devoted. We have the results of the studies and research of Dr. Monson and also of Prentis to refer to.

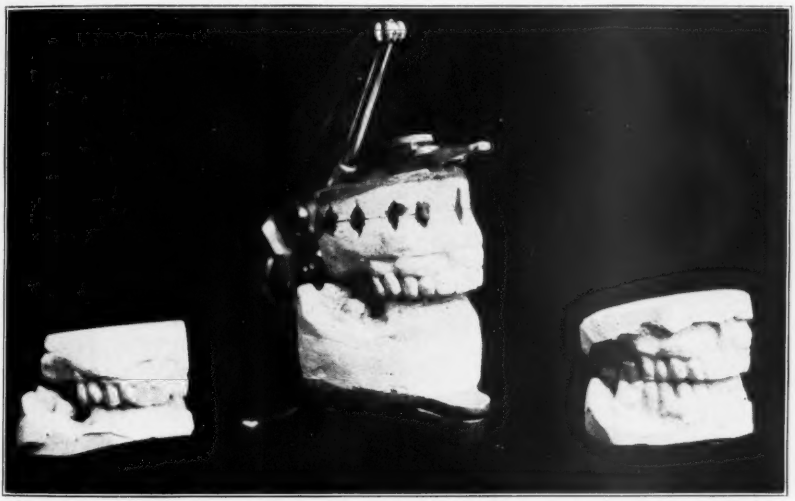

Fig. 6.—Left: Model of case as presented. Center and right: Models of mandible advanced five thirty-seconds inch and occlusion balanced.

Figure 4 shows models of the mouth of a man about 50 years of age. In the first model, at the left, on the right side the maxillary teeth are missing from the cuspid back. On the left side, the maxillary first bicuspid is missing as are the mandibular molars. The absence of sufficient masticating surface has caused the wearing away of the palatal surface of the upper incisors and some on the labial and cutting edge of the lower incisors, until the tips of the lower anterior teeth almost touch the palate and the maxillary incisors are almost cutting the gums below.

By a study of the impingement on the meatus of the ear, facial dimensions and esthetics, coupled with movements shown on models correctly mounted on the mandibulomaxillary instrument, to determine the proper cusp interdigitation and clearance, it was decided to open the bite in this case three thirty-seconds of an inch and to advance the mandible one-eighth inch, in order to obtain a correct occlusal balance. This was one of my earliest cases of any importance; and while satisfactory results were obtained, the bite should have been opened more.

The removable denture supplying the missing teeth on the right side of the

maxilla was supplied with an attachment that allowed of tissue compression and release in a horizontal direction and also a slight lateral movement, so there was no lateral stress against the abutment teeth, which would make it a lever of the second class against the periodontal tissue. This, in turn, would cause absorption at the crest of the alveolar wall and consequent pyorrhea.

A movement in a horizontal direction of 0.25 to 0.5 mm. must be very free, as we must have that movement against the mucosa before it offers much bearing against masticating pressure; also the return movement of that distance must be so easily obtained that the spring or resiliency of the mucosa can push the appliance back, when the force of mastication is relieved, for strangulation causes atrophy. This slight movement, I believe, should be separate from the main retention of the appliance, for stronger retention is usually necessary to keep it in place; or, to repeat, when the same friction is used both for retention and release from masticating stress, the principle is wrong, as we either have insufficient friction for retention or too much to obtain easy relief from masticating stress, against the resilient mucosa.

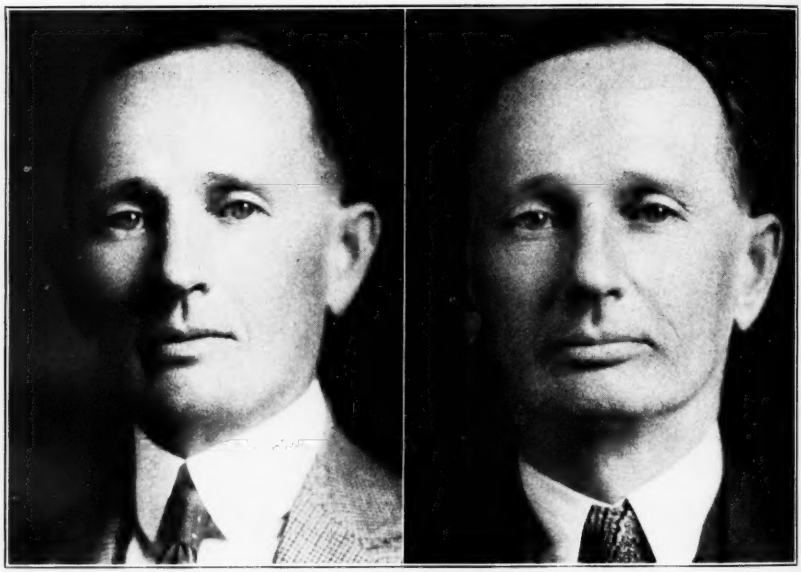

Fig. 7.—Left: Bite opened one-fourth inch. Right: Mandible advanced five thirty-seconds inch and occlusion balanced. Right: Shortened dimensions.

The maxillary anterior teeth are fitted with three-quarters crowns, replacing the worn lingual surfaces and thus bringing them in occlusion with the lowers; for, in partial denture construction, the teeth not included in the restoration must be in arc, by being either left in occlusion or built up to bring them in occlusion. These teeth have been accustomed to a heavy load, and the full force of mastication will not be tolerated on only the partial area of the mandible

or maxilla covered by the denture, without tenderness followed by inflammation and consequent atrophy, which will throw this delicate relationship out of balance, and the efficiency of the restoration is impaired accordingly.

We must have a proper distribution of force and stress, which will aid in the vitality and health of all the parts; while excessive or continued pressure or a lack of proper functioning of any of the parts will cause atrophy and conse-

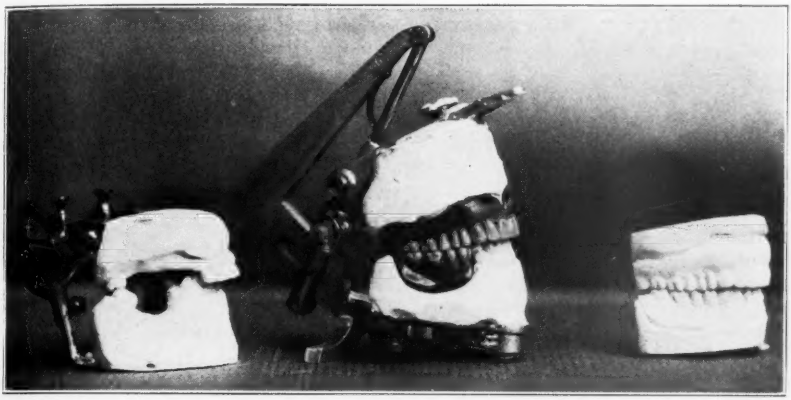

Fig. 8.—Left: Model of case as presented. Center and right: Models showing the bite opened one-half inch, the mandible advanced one-fourth inch.

Fig. 9.—Left: Shortened dimensions. Right: Bite opened.

quent faulty adaptation and unbalancing.

The patient whose denture is shown

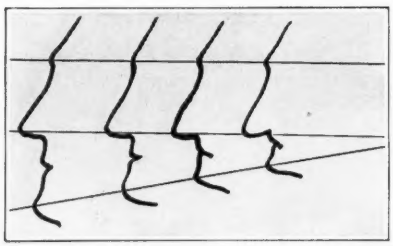

Fig. 10.—Changes that take place in facial dimensions when abrasion or loss of teeth occurs.

in Figure 4 had been trying, without success, to wear different appliances that were made to meet the line of occlusion shown in the mandibular teeth and with the overbite and closure as it is shown on model No. 1.

I restored the mouth as is shown on Model 3 to a satisfactory result, and the patient reports he is doing most of his masticating on the removable piece on the right side. This case was built up about two years ago, and there is no indication of readjustment or rebasing being necessary.

Figure 5 shows a partial superior restoration of the maxillary molars on mounted models.

This view should show the molars in a rest position when they are approximately 0.5 mm. longer than the supposed natural teeth. With the appliance under masticating stress seated in a horizontal direction, the occlusal surface of natural and artificial teeth are forming a perfect arc according to the spherical principle of occlusion.

One should never sacrifice tissue cov-

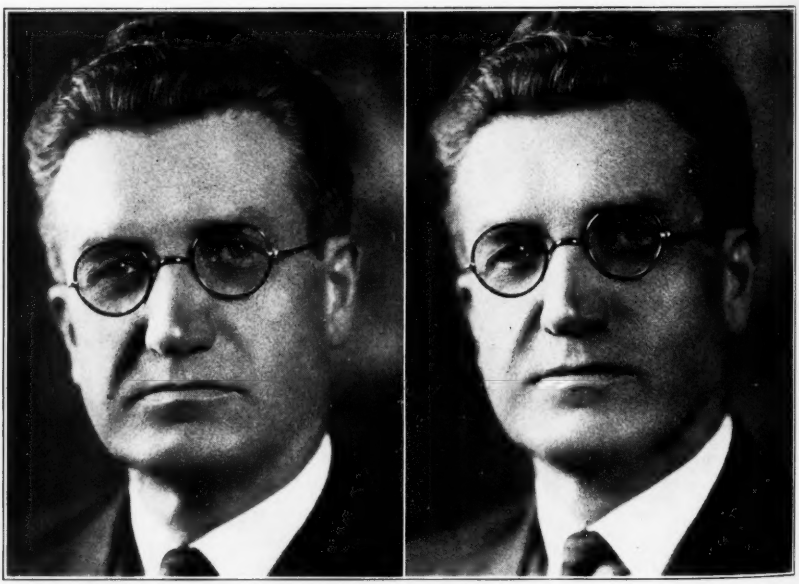

Fig. 11.—Left: Appearance before bite was opened. Right: Appearance after bite was opened five thirty-seconds inch.

erage to get a delicate, pretty piece, but cover the greatest tissue area possible for comfort and proper balancing in relation to the retention points, thereby causing a coactive bearing and the elimination of deadweight, and preventing the force of gravity on maxillary restorations, making the retention point a fulcrum.

In some instances, we may have to supply only one tooth on one of the sides and may want the adjacent teeth to carry the load on this side. We must then have a large enough and a sufficient and properly seated occlusal rest to place the masticating load in the line of the tooth root or the restoration will become an orthodontic appliance.

Figure 6 shows models in the case of the patient shown in Figure 3. The cut at the left shows the case as it was presented with the bite closed with such a retrusion of the mandible that the lower anterior teeth are striking the palate to the point of irritation. The cutting edge of the upper central incisors tip backward in such a way that it is impossible on an articulator to arrive at a determination as to what to do while they are in place; but, being devitalized and diseased, the incisors were removed and replaced by a temporary bridge as shown by the model in the center.

Now by studying this case as compared with the previous one, it was determined to open the bite one-fourth inch and to advance the mandible five thirty-seconds inch. The result obtained in the completed case is as shown with models in the view to the right.

Fig. 12.—Profile views of patient shown in Figure 11. Center: Bite opened five thirty-seconds inch. Right: Nine months later; total opening now seven thirty-seconds inch.

The change in the features that has taken place in about three months is shown in Figure 7.

In Figure 8 (Johnson), the models in the cut at the left show the mouth as presenting. The center and right views show the changes made after the bite is opened one-half inch, with an advance of the mandible of one-fourth inch, these changes being made with a full upper

and partial lower denture and restoring the remaining natural lower anterior teeth to arc. I later obtained the best results in this case when the opening was reduced to three-eighths inch and the advance to three thirty-seconds, allowing the natural lower anterior teeth to come in good occlusion, against a ridge of vulcanite on the lingual of the upper incisors.

Figure 9 shows the changes in facial expressions obtained by these restorations.

Figure 10, from left to right, shows changes in facial dimensions that take place when abrasion or loss of teeth occurs.

Figure 11 (Cleophas), front view, shows appearance before and after the bite was opened five thirty-seconds inch, with temporary splints.

Figure 12, profile, shows the same case. In the illustration shown in the center, the opening is five thirty-seconds inch with temporary splints and inlays, but after being used for nine months, it was worn down to about one-eighth inch. The view to the right shows the bite raised three thirty-seconds inch more, making the total opening seven thirty-seconds inch.

## Discussion

*Forrest Orton, San Francisco, Calif.:* The subject of the occlusal relationship of the natural teeth covers such a large field in restorative dentistry and presents so many facts, that I shall confine my discussion to the emphasizing of one phase of the subject. The subject, "the necessity of occlusal balance in partial denture construction," is fundamental, dealing as it does with the functions of the teeth, and it is therefore the most important factor in restorative dentistry.

Dr. Cleophas has emphasized not only the biologic truism that form is determined by function, but the further fact that (as far as the teeth are concerned) the functioning of the teeth will depend on their form and their relationship to one another, not only in centric occlusion (with the teeth closed at the rest position) but also in eccentric occlusion (during the masticating range of the mandible).

My understanding of an ideal balanced occlusion is a continuous contact on some portion of the occlusal surface "from central occlusion throughout all the range of occlusion, back to central occlusion (Washburn). If the movements of the mandible were confined to a hinge movement, we could have teeth arranged similarly to the carnivorous animals; or, if the movements of the mandible were on a line plane, we could have a perfectly flat plane of occlusion, and have a balanced occlusion during the movement of the mandible. Many animals and some very primitive skulls, those with end to end bites (Eskimos), show very little downward movement of the condyloid path; but modern inhabitants of Europe and North America show a decided forward and downward movement of the mandible (J. Leon Williams).

If the movement of the mandible is not confined to a hinge movement, and does not move on a line plane, but has, as is generally believed, not only a hinge movement but also a downward and forward gliding motion, what geometrical figure is it possible for us to conceive, in which there would be a balanced occlusal relationship between the occlusal surfaces of the teeth except a sphere? It is not necessary to point out to this group that the cusps of the teeth are approximately of the same height, when held in a horizontal position, but when in normal position, the lower teeth are inclined toward the lingual. Consequently, the buccal cusps are higher than the lingual, and, as a result, in a well-developed jaw, the occlusal surfaces will conform to the surface of a sphere. The upper teeth are normally inclined toward the buccal and labial, giving a greater length to the lingual cusps. The upper teeth would, in a well balanced jaw, conform to the inner surface of the same sphere, having the same radial dimension. Now, if the radius is not changed during the movement of the sphere formed by the occlusal surfaces of the lower teeth, we will have continuous contact with the occluding surface of the upper teeth, resulting in what is known as a balanced occlusion. Even though this conception of a balanced occlusion is found only occasionally, and, in the most perfectly developed jaws, this fact does not affect its value as a good working hypothesis upon which to establish a conception of normal occlusion.

Furthermore, as pointed out by Monson, it gives us an engineering basis, from which to judge the most favorable direction of stress; for, with the teeth arranged as described, the direction stress on both the upper and lower teeth will be in the direction of the long axis of the teeth, and hence in the direction of their greatest resistance.

The unfavorable consequences due to the wearing of the occlusal surfaces of the teeth, or the tipping out of alinement of the teeth adjacent to vacant spaces in the arch, have

been generally recognized. But the fact that the consequences observed were due to a change in the direction of the stress brought to bear has not been as generally understood. An understanding of the normal is a prerequisite to an understanding of the abnormal. It seems to me that Dr. Monson has given us the most rational theory of judging the normal or at least the most favorable direction of stress and hence a basis for judging the abnormal or unfavorable; in other words, a basis for diagnosis in Partial Denture Prosthesis.

*B. B. McCollum, Los Angeles, Calif.:* The principles and problems suggested in this paper are well termed the "basis of all dentistry." A study of the masticatory apparatus as a functioning organ of digestion immediately leads us to a study of its related and correlated parts. That these parts which play over one another must have a harmonious relation could hardly be denied by even the most careless. Yet, until very recently, the general profession has taken only a slight interest in this problem, and it is yet to be demonstrated just how great that interest really will become.

Dentistry must cease to be the mere filling and cleaning of teeth. The mouth is an organ of digestion and a most important one at that. To have it function as such should be our basic aim. There are other factors that help in making the teeth and mouth a part of the body all related to the completion of the physiology of the organ, and they should be given consideration as important but secondary elements. They are all one.

Dentistry has always made too much of its cosmetic possibilities. A good looking, pretty mouth and face is the right (and perhaps duty) of every individual if Nature has so decreed, but in any way to make cosmetics our primary or particular aim or to emphasize too greatly the cosmetic possibilities of our work, is to place us in the class with milliners, etc., and destroy the standing to which we are entitled as factors in the healing art.

Our conception of a normal masticatory apparatus has been, and perhaps still is to a great extent, based upon looks and appearance. Orthodontists have made that serious mistake to their eternal regret in attempts at retention. A proper conception of the normal in our work is entirely dependent on an understanding of the mechanical harmony that must exist between the correlated parts in functioning. Biologic problems of all kinds have refused to give up their secrets until they have been approached from the mechanical side. All growth and physiology are the direct result of Nature's use of the principles of mechanics.

The mouth as an organ of digestion is a mill, and from ancient times has been recognized as such. The occlusion of the teeth determines the degree with which this organ will function; hence, it is easy to see that the importance attached to occlusion in this paper is not far fetched. It is the basis upon which we build—"the basis of all dentistry".

The study of the normal in occlusion is a matter of mechanics or mathematics, but not a process of standardization. Proportions and relations of parts make a good masticatory apparatus, rather than any standardized size or position. I believe that an individual could have an oversized or undersized mouth in proportion to the size of his head, and the position of individual teeth from any standard measurement be far off the track, and still, if the proportions and mechanical relations were retained, the mouth would function as it should. It is only by such a process of reasoning that we can reconcile our efforts to operate where mutilation and deformity exist.

# DENTAL ROENTGENOGRAPHY

By F. F. MOLT, D.D.S., Chicago, Illinois

(Read before the American Dental Association, Dallas, Texas, Nov. 10-14, 1924)

DURING the years immediately following Rosenow's announcement of his discoveries in "focal infection" and the detailing of his convincing animal experiments, there is no doubt that extraction of teeth became quite a fad. Physicians at a loss to make a diagnosis or too indolent to attempt careful consideration of a case advised the elimination of teeth. Dentists became internists overnight and, with much weighty discourse on blood counts and cultures, assumed to make general diagnoses and effect systemic cures. Even the laity making their own diagnoses, on the information broadcast regarding teeth as sources of infection, went about having their teeth extracted on their own responsibility.

As was quite natural, there came a reaction, and many who were the keenest advocates of extraction, not only of all "dead" teeth, but frequently of all teeth, became as enthusiastically its opponents.

Recently, we have heard a great deal of the "backward swing of the pendulum." "Backward" is the proper expression; for, if we continue to disparage medical knowledge and ignore our duty as to health factors, all that we have achieved in teamwork between the two professions that should be one will have been lost.

Coincident with the tendency to revert to the dentistry that Hunter condemned there is noted a renewed effort of those of ultraconservative trend to depreciate the roentgen ray. This, as much as any one factor, may be held accountable for the failure of dental roentgenography to keep pace with general roentgenography, and not only to come into more general use but also to develop a broader field and more advanced technic.

No one factor has contributed more to the refinement of our methods of procedure than the application of the roentgen ray to dentistry. Ignoring the information regarding focal infection, this inquisitive investigator has shown up more of our failures and faults in technic than has any other one thing. In the matter of general health, it should have shown us more. No doubt, many have not relished the information it has given and, preferring to consider only the mechanical aspect of dentistry, have resented its interference. Only upon this basis can the antagonism or disinterest in what should be really the foundation of all dental effort be explained.

Four reasons may be suggested for many of the failures upon which have been based the efforts to discredit focal infection theories: (1) imperfect roentgenography; (2) faulty diagnosis; (3) incomplete diagnosis, and (4) inadequate surgery. These are, in many cases, inseparably linked, so that they really become one fault. The roentgenograms may have been so incomplete that an accurate diagnosis was impossible; oral foci assumed to be present were also assumed to be a sufficient source of trouble, and with these inaccurate roentgenograms as a guide, or for some other reason, no thorough elimination of infection has been accomplished. No result! Nothing to the theory!

The quasiprofessional "x-ray laboratory" presided over by an unsupervised technician of no professional attainments, dental, medical or otherwise, is probably responsible for much of the mediocrity in dental roentgenography. The one shining exception, McCormack, cannot redeem this class of laboratories or explain their existence. Lacking dental knowledge and training, the technician in the average "lay" laboratory could not necessarily equal what should be the product of the dental trained roentgenologist. It is a fact difficult to explain, however, that the lay laboratory seems to be the pacemaker, and few radiodontists try to advance beyond the mediocre average of the "radiographic shooting galleries" as Simpson designates them. Most remarkable of all, many dentists and physicians not only accept the usual substandard product, but also trustfully follow the so-called diagnosis thrown in. Many medical men as well are susceptible to the lure of the bargain fee and are just as naive in their acceptance of "diagnoses."

Nor are the medical roentgenographers above reproach in their efforts at dental roentgenography, for some of their accomplishments in this line offer even less value roentgenographically and more ridiculous statements in diagnosis than do the lay laboratories.

What we need primarily to enable us to get the most out of this diagnostic adjunct is a more thorough understanding and knowledge of what constitutes a complete and interpretable *oral* roentgenogram. Even the term "dental" as applied to roentgenography is incomplete; for such a roentgenogram should cover sufficient area to permit of considering all adjacent structures associated with the teeth. The average not-how-good-but-how-cheap product endeavors to cover the ground in six exposures or ten. It can't be done. More frequently than not, in addition to being incomplete, the roentgenograms have not the partially redeeming feature of good photographic texture, so that one endeavoring to interpret them is constrained to guess—and one doesn't need a roentgenogram to do that!

The second point to be stressed is the inability of many dentists to interpret the roentgenogram, if complete and if of proper texture. This may be explained by two facts: Many practitioners received their training before the discovery of the roentgen-ray and its application to dentistry, and most recent graduates have had only superficial and cursory instruction with below-average quality roentgenograms in the clinic with which they have been familiarized. Sufficient graduate instruction and opportunity to learn, as well as greater attention to this basic work by faculties, may in time remedy both sides of this situation.

With this instruction in interpretation will come a knowledge of what texture is desirable, what pathologic conditions are disclosed, how to differentiate between pathologic and plain anatomic deviations, and an ability to link up this *interpretation* with clinical findings and history so that an actual oral diagnosis may be achieved.

The matter of linking this up in turn with systemic symptoms or conditions is the prerogative of the physician, or at least must be achieved by teamwork between physician and dentist.

When the dentist has thorough knowledge of this subject, he will appreciate and demand better roentgenography, and he will realize how much greater is the field for its use than just the search for possible pathologic areas. He will appreciate also the fallacy of "guesswork" dentistry and depend for accurate information on accurate roentgenography. Perhaps, then, we shall not be so often open to the criticism that we ignore frequently and perpetuate often menacingly potential infectious foci.

The failure to produce roentgenograms of even, interpretable texture is due, usually, to lack of a definite start-

ing point. Assuming that the equipment is adequate and used as efficiently as possible, the roentgenogram, properly exposed, will develop to the desired texture in five minutes at 68 F. It is necessary, of course, that the films as produced be free from fog, that they be carefully handled in developing, and that fresh chemicals, properly mixed, and clean wash water be used a sufficiently long time. This texture should not be dense enough to be impenetrable to ordinary light; nor light enough not to display detail and contrast.

Any number of films used to make a "complete" mouth roentgenogram falls short of adequacy if it leaves any portion of the mouth insufficiently portrayed. The essentially mechanical procedure, therefore, of "shooting" a given number of films from certain angles and dismissing the patient without first developing and examining the roentgenograms carefully and reexposing any doubtful or unusual area or condition is to be condemned. No technic can be universally adopted, nor can every mouth be roentgenographed from universal angles. Some films, therefore, will fail to make the mark. A six-film exposure is utterly inadequate, and ten films are frequently little better. Even a twenty-film exposure must, in many cases, be amplified by reexposures.

The roentgenographic half of the production of a properly exposed and developed roentgenogram calls for a proper positioning of the patient as a first step. This should be such that with the patient sitting erect, maxilla and mandible are each on a horizontal plane as that portion is roentgenographed. If the patient is recumbent, the plane should be perpendicular.

We cannot arbitrarily designate the angle at which the film should be placed in the mouth or the ray directed toward it. Anglemeters based on averages have done much to eliminate guesswork. We must still adapt these angles to the individual case, keeping in mind constantly that we wish to avoid distortions, if possible. Distortion may be longitudinal by elongation or foreshortening, or lateral by overlapping or angulation. Elongation or foreshortening in a slight degree may in no measure detract from the value of the roentgenogram in diagnosis except that it may cause a misconception as to the size of a pathologic area. The worst type of roentgenographic distortion is that which has been called the "hospital type," in which the teeth are so attenuated and the root ends so out of focus that no knowledge may be had of conditions present. Frequently, the root ends are not shown in the film at all.

Bending the film is responsible for many faulty roentgenograms as is also the attempt to cover too great an area on one film. Stiff backed films of only sufficient width to show in focus a small group of teeth are preferable to the wider films with an inaccurate representation. Areas as shown should overlap sufficiently to link up one view with another.

A pathologic area disclosed in part, or suggested, should be shown completely by additional exposure, or exposures, and the practice of showing a part on one film and part on another should be avoided.

If the roentgenogram is being used to check a canal-filling procedure, no distortion is permissible. Overlapping of images is avoidable if there is no malposition of the teeth. Accuracy in this regard is especially essential in portraying impacted and unerupted teeth, particularly third molars. Winter has given us some valuable points in this regard. Any roentgenogram that shows only part of an impacted third molar is culpably incomplete.

Pyorrhea conditions are disclosed by accurate representations of the interdental spaces, and here again no overlapping of shadows should be permitted if the teeth are in normal alinement.

The relation of root ends to foramina

and particularly of upper molar root ends to antrum floor should be unmistakably shown, if possible. In altogether too many cases, by far the major portion, the malar shadow is permitted to obscure these root ends in part or entirely. This may be avoided either by the use of the distance technic, suggested by McCormack, or by the use of cotton rolls or a holder to achieve as nearly a perpendicular position of the film as possible and by the direction of the ray at a right angle to the film. The infrequent combination of a low and heavy malar with a very low palate may defeat this effort.

The maxillary tuberosity should be shown, and without the overlapping of the coronoid shadow of the mandible. Many tuberosities are distinctly pathologic, seeming to receive drainage from other areas. Therefore, a failure to show these also means an incomplete roentgenogram.

There is a variation in the calcic content of the bony structures in various cases. This may be significant of systemic conditions that cannot be disregarded. It would seem desirable, therefore, to adopt a standardized technic as regards penetration, having already standardized our development and exposure procedures, which will give us, in the majority of cases, the texture that we consider desirable, producing clear blacks and whites and definite contrast. With this average as a standard, therefore, we may determine, by the deviations from a "norm," the excess or deficiency in calcium salt content. This, with a careful study of the bony structural characteristics, may be, in many cases, a valuable aid in systemic diagnosis.

Edentulous mouths and edentulous areas in mouths partly dentulous should be roentgenographed invariably. There may be disclosed residual pathologic areas, root fragments or areas of compact or sclerotic bone. The significance to be attached to the latter is a mooted point, but its presence should be clearly shown. In roentgenographing edentulous mouths, landmarks, of course, are missing. The tuberosity, antrum and median suture should be shown for this purpose in the maxilla, and the retromolar triangle in the mandible. If the position of a pathologic area or root fragment to be operated for is still in doubt, a metal marker may be attached to the tissues in a location approximating the point of incision, its position marked with an indelible pencil on the tissue and additional exposures made.

Some years ago, Moorehead presented a paper on "The Anterior Problem," calling attention to the fact that if our profession is to achieve the object of its existence, it must do it by preventive dentistry rather than by patching up the end-results of neglect, disease or previous poor dentistry. No more timely and forceful exposition of this subject has been presented, but how constricted has been its acceptance, and how generally have we gone on with our patching, ignoring prophylaxis with its bearing on caries, gingival destruction and traumatic occlusion!

All that has been presented here as necessary in a roentgenographic product designed to detect the presence of pathologic lesions of high or low grade applies to the type of roentgenogram that has a prophylactic objective. If complete oral roentgenograms are made at definite intervals, they will disclose approximal carious areas before it is possible to detect them by the use of exploring instruments. They will disclose beginning gingival destruction and give definite information as to the formation and extent of pyorrhea pockets; and they will disclose the widened pericemental line that indicates trauma in occlusion. What more valuable factor may we have in working out this "anterior problem"? and how few dentists avail themselves of its use!

A complete oral roentgenogram may advantageously be amplified by lateral

jaw extra-oral exposures, made with the teeth in normal occlusion.

Having obtained, then, roentgenograms of interpretable texture and being prepared with a properly lighted viewing box and a reading glass to go into the matter of interpretation, how shall we go about it? Not by a cursory superficial glance and not by jumping from one gross area to another, ignoring less apparent but possibly more important lesions. The roentgenogram properly assembled should be examined as one would read a page, comparing one view of an area with the adjacent one, ruling out anatomic deviations or possibilities, and noting all departures from normal.

Each tooth crown should be examined for caries, and the interdental space noted for gingival destruction, with attention to any pockets disclosed as well as to overhanging fillings or crowns. Next, each root should be examined in relation to the pericementum and the lamina dura (or the compact bony wall which forms the "tooth socket"). Any deviation of either from the normal fine line, one black, the other white, has some significance. Malformations of the roots, as well as both hyperplasia and hypoplasia (hypercementosis and absorption), should be observed; and any periapical thickening or such periapical lesions as pericementomas, perialveolar abscesses or cysts, noted. The root canal and pulp chamber are examined for pulp accretions, canal fillings or obliteration of the canal.

Malposed and unerupted teeth, unless the patient has not reached the age for their eruption, should be noted. It is to be hoped that the coming generation will have fewer impacted cuspids, and will not be permitted to endure the neurotic complications consequent on their disturbed or delayed eruption as well as that of third molars. Early knowledge of these conditions is essential, as the expansion of the arches to provide space for the teeth or the extraction of others, when indicated, may so advantageously be taken care of during early years.

Bony structure is examined both adjacent to the teeth and in edentulous areas, retained root fragments, radiopaque or radiolucent bone areas are marked, and any deviation as regards the structural manifestations commented on.

Having noted these points, it is desirable to check by clinical examination, history and symptomatology. The clinical examination may desirably include the testing of teeth for vitality, the verifying and exploring of pockets by probing and the instrumental examination of tissues and tooth structure. The history should include any previous roentgenograms available, and should be linked up with the present symptoms and past history of trouble, if any.

In such a way, logical interpretation may be achieved and a competent diagnosis built thereon. The basis of the whole structure, however, is a *complete* roentgenogram of *proper texture*. Nothing will take its place in diagnosis, and nothing tend more to advance the quality of our work individually and the value of our services as a profession than the consistent, intelligent and constant dependence thereon.

## Discussion

*Clarence O. Simpson, St. Louis, Mo.:* One of the greatest handicaps to the advancement of radiodontia in most localities is the commercial laboratories. About four years ago, the American Dental Association passed resolutions condemning commercial roentgenography, but no constructive action was taken. The laws of all states restrict the practice of dentistry to licensed operators, yet there is no enforcement of the regulations in this important branch of practice. The insertion of foreign materials in the mouth, the manipulation of the tissues, and the exposure of the patient to a destructive radiation is a risk greater than that of many reparative operations. The unlicensed technician is especially in evidence along the Pacific Coast.

The backward trend or reaction to which Dr. Molt referred is partially due to the humiliating revelations of roentgenography and an inclination to shirk the operative requirements imposed by roentgenographic inspection. Radiodontia will not offer its

fullest possible service until it becomes a routine feature instead of an occasional accessory to dentistry.

Dr. Molt uses the word "texture" where his meaning would be better conveyed by the accepted photographic term "density." Texture describes the pattern or physical structure rather than the chemical density or degree of opacity.

The theory that the superimposition of the malar process and malar bone on the molar roots can be avoided or minimized by increasing the target-film distance is a fallacy. The idea probably originated by men making exposures under unfavorable projection conditions, then using a longer target-film distance and changing the angle of projection, which improved the results. They would have improved the results just the same by crossing their fingers or closing one eye after correcting the angle of projection. Theoretically, increasing the target-film distance lowers instead of raises the superimposition of the malar structures because there is less divergence of the rays producing the image.

Films of special size with a rigid backing are not essential for diagnostic roentgenography. Their lack of adaptability to the form of the mouth increases the distance between teeth and films and compels a less desirable angle of projection than with flexible packets. The unsightly bent portion of standard films often adds important information to other views.

A standardized exposure is not conducive to the maximum diagnostic value of roentgenography. The suitable penetration for a young patient is insufficient for a vigorous, ruggedly developed adult. The structure and type of bone can be adequately demonstrated with the penetration modified to the requirements, and correct penetration produces uniform negatives of better detail and contrast than those obtained with a fixed penetration.

*Dr. Molt (closing):* With regard to the use of the term roentgenographic density instead of the word "texture," I have simply accustomed myself to using that term and believe that it means the same thing, at least it does to me.

Now, Dr. Simpson has made some very pretty drawings here and I may say that he and I have had occasion to cover the back of many a menu card with drawings similar to these. I contend, as I have invariably when we have discussed these subjects, that his own drawings defeat his argument. For instance, the angulation of the ray is the same for the distance exposure as for the less distant exposure. He has given you this as the angle from the target at the 36-inch distance and a much broader angle from the 16-inch distance.

*Dr. Simpson:* That is the divergence of the ray.

*Dr. Molt:* The divergence of the ray is just the same from one distance as from the other (illustrating).

We will consider we are working with light rays, and the roentgen ray is essentially a light ray. We will take a candle, for instance, and put it at this point; we will direct a ray and have a shadow thrown of this object, which is in this case the malar shadow as against the film in position as we see it here. We will assume that our film is in that position and our tooth in this position. Now the distances from target to malar and to film are different from the distances in this other position. If you experiment with shadows, you will find that the shadow is correspondingly larger as the source of the light approaches the object, and so the shadow will be greater of your malar from this distance than from this.

As regards the padding out of the film, I will also take issue with Dr. Simpson because frequently we will find the approximate position of the malar structure and the tooth and the film such that by no deviation of the ray can that malar shadow be thrown out.

Now we have a theory that we must bisect the deviation between the long axis of the tooth and the long axis of the film and direct our ray approximately at right angles to that line. Quite naturally, if you can change the position of this film so that it comes, for instance, in a more upright position, you have achieved something in ability to direct your ray from the lower angle.

Another point in the distance technic is that it cuts out a certain amount of secondary radiation, although this is a theoretical point entirely. Suffice it to say that, in my hands, I have found greater success and better roentgenographic texture resulting from the use of the distance technic.

Comparing the stiff backed film with the flexible film is also susceptible of some argument, because you have a definite shadow thrown here as contrasted with an indefinite shadow where the film is bent. While frequently the distorted roentgenogram will bring out advantageous points, you have on the edge of the narrow films the same distorted image of your bicuspid.

# THE NEGATIVE PRESSURE METHOD OF IMPRESSION TAKING

By C. J. STANSBERY, D.D.S., Seattle, Washington

(Read before the American Dental Association, Dallas, Texas, November 10-14, 1924)

IT is not within the scope of a paper on impressions to consider the problems of articulation or occlusion, or other problems in their effect on the finished denture. By my method, the impression is reproduced in detail in the finished denture, it being unnecessary to make changes such as marginal corrections or corrections for tissue relief. The requirements of a denture are that stability, retention and comfort be attained and that at the same time as little transgression as possible be made on Nature's plan for the maintenance of the health of the underlying tissues. To acquire stability, we must get an even, positive bearing on the ridges, both during mastication and when the muscles are at rest, the ridges being the foundation tissue directly sustaining the forces of mastication. To acquire retention, it is, briefly stated, necessary to take the impression in such a way that the entire periphery slightly encroaches on displaceable tissue, which has a constant tendency to regain its original position. A negative factor as regards both stability and retention is pressure along the median line of the hard palate, which may act as a fulcrum when the tissue on the alveolar ridge is being compressed during mastication. Another negative factor is the elasticity of the pad of tissue overlying the anterior palatine artery and its main branches, if the technic employed has resulted in pressure over this area. To acquire comfort, one must not lower the health of the underlying tissues by interfering with the normal blood supply, producing pressure over the nerves; nor by allowing undue tissue impingement, especially on labial and buccal margins.

These premises form the rule and guide in impression procedure: stability, ridge bearing; retention, peripheral encroachment; comfort and maintenance of health by avoiding circulatory disturbances and undue pressure.

No edentulous mouth can be considered, in the strict sense of the word, normal; for no doubt Nature's plan is that our teeth should last us throughout our natural life. However, we have all seen edentulous mouths that have for some time worn no artificial dentures, and they were tough, and in a hard, robust condition; indeed they had attained quite a degree of efficiency in "gumming it." It is this condition that we should try to maintain under our dentures. A ridge with a roll of soft, spongy tissue along its crest, which would permit of a much better foundation if this tissue were removed, should be operated on. In my practice, I insist on this removal; and, if the patient objects, it is a good time to stop before beginning. Here is the patient's first opportunity for cooperation, and if he fails you here, why expect it in his getting accustomed to the new teeth? The

ridge must bear the burden of mastication, so we must insist that it be in the best condition possible, though this may, at times, be far short of what we wish.

In any tissue, there is a certain proportion of cellular tissue to vascular volume. For want of a better term, call it normal balance. A so-called compression of tissue is but a diminution of the vascular content, the contents of the arteries and veins being forced out of the tissue. The normal balance between the vascular capacity and the tissue to be nourished is thereby disturbed. It is axiomatic that, to preserve the health of any tissue, its blood supply must be normal and uninterrupted, and the tissues underlying a denture are no exception.

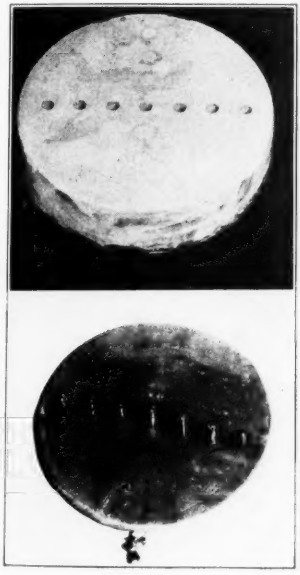

Fig. 1.—Above: A slab of artificial stone in which a series of holes of equal diameter and depth and equidistantly placed have been drilled. Over this a large piece of warm modeling compound is placed and subjected to pressure against a flat surface. Below: The result of the experiment. The varying amounts of modeling compound that have been forced into the holes are but a measure of the variable pressure immediately surrounding that particular hole. It will be seen that the pressure is greatest at the location farthest from its escapement, and gradually lessens until the point of escapement is reached.

### ANATOMY

The principal blood supply of the vault of the palate is from the anterior palatine arteries entering through the posterior palatine canals and running forward about midway between the alveolar ridges and the median line of the palate, to pass upward through the lateral canals of Stenson and there anastomose with the nasopalatine. During this course, they give off lateral branches both toward the median line and toward the alveolar ridge. The gums and mucous membrane of the lip and cheeks adjacent receive their blood supply from the terminal branches of the infraorbital and alveolar branches of the internal maxillary. Now, let us observe the blood supply of the palate and peripheral tissues with a natural denture in place. The natural teeth, especially the square shaped teeth, with but little space between their necks and thin septums between the alveoli, practically form a barrier between these two blood supplies.

### EXTRACTION

The result is that, in the alveoli, blood clots form, which are afterwards replaced with bone from the alveolar walls; and the tissue proliferations from the margins of these clots unite the buccal and palatine tissues and with them extend the terminations of the blood supply of these margins. Any pressure on the palatine canals will have its effect more markedly on the termination of the blood supply than along the arteries of greater caliber.

### MATERIALS

Now, of prime importance, comes the consideration of the materials with which we are to work.

*Physical Properties.*—First bear in

mind the physical properties of all the materials used and try to make use of these properties in such a way that they will aid in the result desired. A physical property that greatly concerns us in impression taking is viscosity. Internal resistance to flow or internal friction are names sometimes given this property. It is present in all liquids and varies greatly in different liquids. Ether, water, sulphuric acid, linseed oil and molasses represent a series with an ascending degree of viscosity. The inverse, or opposite, of viscosity is fluidity. In the materials with which we are concerned, plaster of Paris and modeling

Fig 2.—Coiled spring made of modeling compound. This is made by forcing warm modeling compound from a wax gun and, while still warm, wrapping around a small test tube, into the form shown on the right. The figure on the left shows the coil compressed. On release of the pressure, it will resume the form shown on the right; which proves that modeling compound at ordinary room temperature possesses considerable elasticity.

compound, the viscosity varies with the proportions of the mix and stage of setting for the first, and the degree of heat for the second. Plaster of Paris, in its thin, creamy stage, has a high degree of fluidity and low viscosity, and in this condition behaves in accordance with the laws of hydraulics. One of these laws is that pressure on a confined liquid is transmitted equally in all directions. If modeling compound, in any degree of heat sufficient to render it plastic, is subjected to pressure between two rigid surfaces, with escapement only around the margins, the area of greatest pressure against these surfaces will be that portion farthest from its escapement, and this pressure will vary according to the viscosity or degree of heat. Bearing this in mind, it will be seen that it is impossible to take an impression using modeling compound only and attain a uniform degree of pressure on the entire surface of the compound. This also applies to waxes and any materials that have considerable viscosity or internal resistance to flow (Fig. 1).

*The Tray.*—The form increases the rigidity over that which the same amount of tray material in the flat form would exhibit. This may be illustrated with a flat piece of tin and a pail cover. The first would bend easily, while the second might sustain the weight of a man even though supported by its edges only. This form of the tray also lessens its range of elasticity, but makes it more elastic, elasticity being defined as the property of material that causes it to resume its original shape after distortion. A marble or billiard ball has greater elasticity than has a rubber band, since, on bouncing from a rigid surface, the ball more nearly regains its original form than will the rubber band when stretched.

*Modeling Compound.*—At ordinary room temperature, the modeling compound possesses considerable elasticity (Fig. 2). All of the properties enumerated are brought into action during the technic of impression taking. In the drawing (Fig. 3), *RHL* represents a rigid surface and across *RL* an elastic bar *SE* (something elastic) is placed. If a force *F*, of 10 pounds, is exerted upward against the middle of *SE* sufficiently to bend this bar to the position represented by the dotted line, both *R* and *L* are exerting 5 pounds each in the direction opposite to *F*. *H* stands for hook, and if we place the bar over the hook, we may then remove the force *F* of 10 pounds and the bar will be maintained in its bent position by *H;* but

*H* in turn must do the work that *F* was doing; that is, pull up 10 pounds. What I wish to emphasize is that the bar is pulling down 10 pounds on *H*, while the ends are pushing up 5 pounds each.

*Summary.*—We should bear in mind, for practical application, the property of viscosity of modeling compound, the fluidity of thin plaster and the elasticity of both the modeling compound and the contoured tray, reviewing the experiment of the elastic bar to the deduction of transferring the force *F* to the hook *H*, and recalling the following points: stability, ridge bearing; retention, peripheral encroachment; comfort, preservation of health. The blood supply should be visualized, and one's reason will determine whether or not it is a vital factor. The points brought out in the paper so far, I wish to call the fundamentals, and as such I shall frequently refer to them.

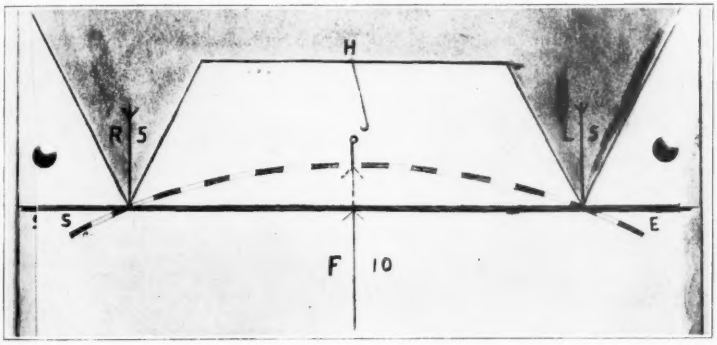


Fig. 3.—Diagram showing properties brought into action during impression taking. *RHL*, rigid surface; *RL*, elastic bar; *SE*, something elastic; *F*, force of 10 pounds; *H*, hook.

### TECHNIC

First, a modeling compound cast (Fig. 4*b*) is made by warming a large portion of modeling compound to a putty consistency and forcing it into a wet, chilled modeling compound impression (Fig. 4*a*) taken in a solid tray large enough to cover all of the tissues involved. This is a preliminary step and conforms to nothing except convenience. On this modeling compound cast, the tray (Fig. 4*c*) is formed, Dr. Giffen's flexible trays Nos. 1 and 3 being used for this purpose. The tray is closely adapted to the cast; the buccal and labial margins are trimmed low enough to avoid any possible impingement on the buccal and labial fold or muscle attachment, and the posterior margin is left long enough to include the post-dam. The only fundamental reference here is that the tray, by reason of its shape, now has an elasticity it did not have while in the flat form.

Next, modeling compound is placed in the tray and an impression taken of the modeling compound cast so that the average thickness of the modeling compound in the tray is about 2 to 3 mm. A portion of the modeling compound is cut out about the size and position of a large airchamber, exposing the tray beneath, and the compound is warmed under a stream of hot water and placed in the mouth with firm pressure over the cuspid and molar regions, to correct the appromixate impression of the ridges. The fundamental reason for the cutting out of the palate portion is to allow the modeling compound to escape in both directions from the crest of the ridge

and therefore have the greatest pressure on the ridge itself. The tray and modeling compound is now chilled and so maintained throughout the future steps, except in that particular portion receiving attention. The entire peripheral margin, a portion at a time, is then warmed, and muscle trimmed by grasping the cheeks and lips between thumb and fingers and pulling down. This should be done in such a manner that the margin is no longer in contact with the mucous fold when the tissues are at rest—a muscle trimming so excessive that it is of no value as a peripheral seal. The modeling compound should present to the cheeks and lips a smooth, flat surface approximately one-half inch wide. The use of this flat surface will be obvious in the final step.

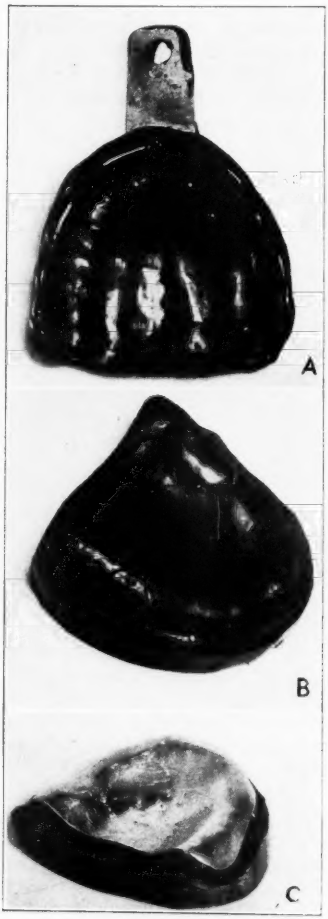


Fig. 4.—Models illustrating constructive sequence. The closeness of the tray's adaptation should be noted. Over casts which show a high vault, it is desirable that the tray be allowed to remain nearly horizontal from ridge to ridge except at the posterior margin.

The posterior margin is now trimmed to a right angle to the palatal surface, the operator making sure that it is amply long. This angle is marked by a slightly moistened indelible pencil, and after the palate is dried with a cotton roll, the impression is put in place and the patient is instructed to swallow. On removing the impression, a fine, definite line on the palate shows the position of the margin. The patient's nostrils are closed with the thumb and finger, and he is instructed to open the mouth wide and compress air into the nasal cavity. This will cause the soft palate to be deflected sharply downward and by observation of the indelible line be a guide as to whether the posterior margin of the impression has been placed correctly. If not, correction can easily be made. The proper position is just to the point where the movement begins. As a post-dam, soft black wax, carding wax, a strip about one-eighth inch wide and 20 gage thick, is used. When this is laid on along the determined margin, the impression is once more introduced and firmly seated. This cannot interfere with blood to the palate because it lies distal to the foramen, and the soft palate is copiously supplied with blood from the ascending pharyngeal and ascending palatine. Another mitigating condition is that the line of post-dam lies in the same general direction as the lateral branches of the anterior palatine.

The impression is now ready for the final step. First, the tray is exposed by removing the modeling compound from the palate portion, leaving only a strip under the post-dam about one-quarter inch wide. Laterally, the modeling compound is removed about to the line where the concavity of the palate meets the convexity of the ridge. The cutting away of the modeling compound

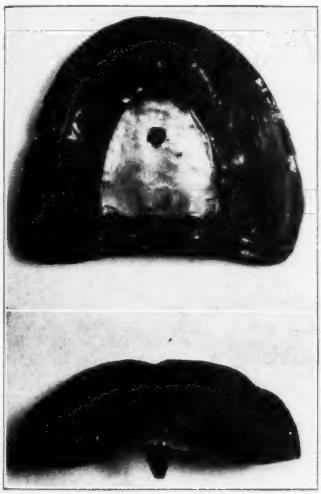

Fig. 5.—Above: Owing to the difficulty of showing photographically the small difference in the shade of red between trimmed and untrimmed modeling compound, this difference will have to be looked for in the picture as a surface characteristic. The width of post-dam, also the flattened buccal and labial border and the tapering of the modeling compound between the ridge and palate portion may be noticed. Below: A cross section of the model above, showing the wax cone in place and the untrimmed modeling compound forming the seat for the ridge.

is extended to include the posterior palatine foramen distally and the anterior palatine in front, all the edges being beveled slightly. The tray is perforated in about the center of its exposed area, a hole one-eighth inch in diameter being made, and this perforation is sealed on the lingual side of the tray with a cone of base-plate wax about one-quarter inch long.

The buccal and labial flange of the impression is prepared as follows: Along the crest of the muscle trimmed modeling compound, another millimeter is taken off for good measure, and a little more than this where either labial or buccal frenum is attached. From the inner surface of the modeling compound flange, the surface that is in contact with the buccal and labial tissue of the ridge, the modeling compound is cut away to a depth of 2 or 3 mm., gradually tapering out near the ridge. The impression is now prepared for the final step, and should present only the bearing surface of the ridge and the post-dam in contact with the tissue (Fig. 5, above).

In order that the procedure may be somewhat anticipated, in this final step comes the application of elasticity of tray and modeling compound, fluidity and viscosity of plaster of Paris and the application of the experiment of transferring *F* to *H*. The resultant of all these is: bearing on the ridges; relief of median line and area over blood distribution, and peripheral displacement of tissues.

With tray and modeling compound prepared as described, the plaster of Paris is mixed for the final impression. A method of mixing plaster that fulfils the requirements is as follows: Into a solution of one-third ounce of saturated solution of potassium sulphate and two-thirds ounce of lukewarm water, snow white plaster is sifted until the plaster nearly shows above the surface of the water. When all surface plaster has settled beneath the surface of the water, the surplus water is poured off, and the mixture is stirred briskly until the first signs of thickening begin to appear. This thin, creamy plaster is poured into the tray, which is shaken

well from side to side. Experience will determine about the right amount.

Everything done thus far is but preparatory to placing the tray and plaster in the mouth, and if this is not done correctly, the previous care counts for nothing.

The tray is inserted in the mouth, and at the same time the cheeks and lip are distended so that the entire periphery will be in full view. Then a slightly oscillating upward movement is given until the plaster appears over the entire periphery. At this stage, the lip and cheeks are dropped, and, with further pressure to the ridge of the tray at about the bicuspid region, the tray is firmly and accurately seated on the alveolar ridges. Now, uncovering the perforation by displacing the wax cone, the fingers are allowed to slide from the ridge to the median line of the tray, but the perforation is not covered. Then a further heavy pressure is given. This will cause the plaster to exude through the perforation. If the pressure is relieved, the plaster will be drawn back through the perforation. This must not happen, but while still under pressure a finger tip slides to seal the perforation and the pressure is then released but the seal is maintained. All this must be done while the prevailing characteristic of the plaster is fluidity. Turning the attention to the impression buccally and labially to the alveolar ridge: Here the degree of fluidity that is desirable in the palate is not indicated, but a more viscous consistency meets the requirements. The degree of setting has accomplished this. The trimmed buccal and labial flanges act as a deflector over the top of which the surplus plaster must flow, continuing down the outer sides under the cheeks and lip. The resistance to this exit causes a back pressure that brings an even, gentle displacement of the tissue at the periphery, a greater displacement vertically of tissue against tissue than horizontally of tissue against bone. This peripheral margin is further formed and muscle trimmed by massaging the cheeks and lip when the plaster has reached a slightly thickened consistency. The massage should be carried out with thumb and finger placed on the cheeks and lip directly external to the flat exterior of the flange described in the modeling compound portion of the tech-

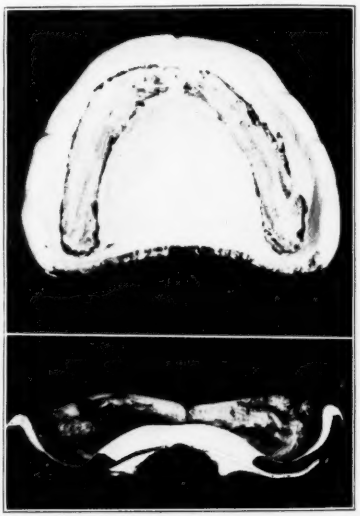

Fig. 6.—Above: Palatal aspect of impression. Below: Cross section of model shown above, at the point of perforation. From left to right note the following points; first, the film of plaster on the buccal side of the flange that has been left after the massage through the cheeks has forced the plaster to the position directly over the buccal flange for the sake of retention; second, the plaster in its varying thicknesses lying against the buccal surface of the ridge; then, the seating of the ridge, shown by but a thin film of plaster remaining at this point. The finger print on the under surface of the tray made there while sealing the perforation may be noted and particularly how the finger tip has been drawn up through the perforation by the suction or negative pressure when the tray was allowed to resume its unsprung position. The same suction that was exerted on the finger tip by the plaster while in fluid condition was exerted on every other like area, surrounding this confined plaster.

nic. This massage will cause a slight displacement, more than that which was caused by the mere flowing over the flange when the impression was seated on the ridges. The left hand is used for this massage, as the right is still engaged in maintaining the seal in the palate. When the plaster has thoroughly set, it is removed and examined.

The palatal aspect of a well-taken impression (Fig. 6, above) should show modeling compound over the entire untrimmed ridge as evidence that the plaster was sufficiently fluid when the tray was seated. It should also show the entire wax post-dam. All other surfaces should present a plaster surface only. There should be no bubble on the palate, which would indicate a leakage of the seal. At no place should the modeling compound of the flange be exposed.

## CONCLUSION

Let us now apply the fundamentals to this finished impression, using the impression as evidence as to whether or not they have been fulfilled.

1. An even, firm pressure on the ridge makes for stability. The modeling compound showing through the plaster confirms this (Fig. 6, below).

2. The exudate of plaster from the perforation when the median pressure was applied and its being drawn back on release of pressure should prove the elasticity of the tray and modeling compound.

3. The heavy pressure with perforation uncovered is the force *F* in the experiment, the plaster is the hook *H* and the sealing of the perforation is the hooking of the force *F* onto the plaster *H*, which, in turn, has to be supported by the tissues beneath. The fact that the palate portion of the impression, that taken in plaster, adheres and does not break away from its modeling compound surrounding shows that the tray and modeling compound had returned to their original, unsprung condition before the plaster had set. Fundamentally, all this was done to relieve the hard median line and area over the blood supply.

4. The peripheral seal for slight displacement of the margin was made by massaging the plaster that had run over the edge of the modeling compound flange back against this peripheral line. This is done in answer to the fundamental of retention. May I call attention to the fact, that, while the impression was taken at one time, three distinct areas, each with its own individual condition, existed: (1) the area within the post-dam and modeling compound under a suction or negative pressure; (2) the area of the ridges under heavy pressure, and (3) the area without the ridge, taken under a variable pressure increasing from ridge crest to peripheral seal. As a distinctive method, based upon logic and confirmed by clinical use, this procedure, called "the negative pressure method of impression taking" will do away with many impression problems.

## DISCUSSION

*V. C. Smedley, Denver, Colo.:* As regards the matter of refusing to work for a patient who is not willing to have a soft tissue roll removed on my recommendation: I am not sufficiently sure in my own mind that the removal of this tissue is essential to satisfactory denture service to justify my taking such a positive stand. I had two sisters, some months ago, with upper edentulous jaws in similar states of excessive anterior resorption. I advised the surgical removal of this soft, flabby roll in each case. One of the sisters had this done and the other refused. I finally got both of them fitted with satisfactory dentures, but the one who did not have the operation was fitted much more promptly, with less discomfort and with fewer trips to the office for treatments and adjustments; and, if there is any difference, the one who did not have the operation now has the more satisfactory and stable denture. It is obvious, of course, that just these two cases are not sufficient to demonstrate the inadvisability of this operation, and I still recommend it in practically all of such cases. There is one other point in favor of not refusing to make

dentures for patients who are unwilling to have this operation. If the result does not turn out as well as it should, it gives one a chance to "pass the buck."

I wish to emphasize what, to me, is the fundamental thought in Dr. Stansbery's paper, by quoting his exact words: "One must not lower the health of the underlying tissue by interfering with normal blood supply, producing pressure over nerve-distribution, or by allowing undue tissue impingement, especially on labial and buccal margins." He has developed technic for securing this most desirable result. But I should like to ask a question: Is Dr. Giffen's pliable tray metal sufficiently elastic, even after it has been pressed to a tray form, to assure the desired negative pressure at *H*, as on the diagram? I can see that, granted a perfect elasticity of the tray metal, a downward or negative pressure of 10 pounds would be secured if there is an upward pressure of 5 pounds on each lateral ridge area; but if this tray metal is so heavy in lead content as to be practically without elasticity, no matter what shape it is in, it seems to me that there is little, if any, negative pressure recorded in the making of this impression. If this opinion of mine is correct, it does not invalidate or condemn this technic, but simply calls for the substitution of a tray with the correct quality of elasticity.

The fundamental principle of this paper, calling for an adequate relief of pressure, impingement or interference with the normal nerve and blood supply, is unquestionably correct, and the technic worked out and described is scientific and excellent. I believe, however, that for practical purposes, in the average case, the necessary relief over these foramina and distribution areas can be procured more simply by a judicious scraping of a good ordinary plaster impression. The best and simplest plaster impression technic, with slight modification, is, I believe, one of the methods described for us by Dr. George Henry Wilson. An ordinary tray, large enough to permit the wings to extend from one-eighth to one-fourth inch beyond the ridge all around, is selected, and a roll of soft beeswax, about the size of a lead pencil, is laid across the heel and fitted into the mouth. The wax must extend well back of the condyles and slightly onto the soft palate. It is trimmed off square just distal to the desired plate outline. Now, one small piece of soft wax is placed at each of the cuspid regions and the tray is inserted again, the cheek and lips being manipulated freely to make sure that the tray is not seated too high, as it would distend unduly the movable tissues. The wax thus placed in these three areas provides for a definite seating of the tray with the soft plaster in place; with a decided compression or post-damming effect across the heel and without undue distension of tissue at any part of the periphery. The plaster is mixed to a creamy consistency and just before it is ready the patient rinses the mouth. The tray is filled with plaster and with the spatula in the right hand, assisted with the index finger of the left hand, the operator quickly places the soft plaster in the vault of the mouth and between the cheeks, lips and ridges to exclude air pockets. This is followed immediately with insertion of the tray. As the plaster begins to set, the cheeks and lips are manipulated, the periphery of the impression being thus molded as Dr. Stansbery describes in his paper.

*W. F. Chappelle, Buffalo, N. Y.:* There was just one question that came up in my mind: Is any relief used in the impression or on the model? In taking an impression of this kind, you have the tissue area that is very much softer than the tissue in the median line in a great many mouths. In some mouths, you have a tissue that has a great deal of mobility on the positive and negative pressure. In pressing this up, with the plug in place, and exerting a positive pressure, considerable compression will occur, and when that pressure is released, there is a downward pull. If no contact is lost with the tissue, it should give a greater pull here and there than over the thin tissue. The final result might be compression of soft areas or distension of the same according to the consistency and degree of setting, at the time change from positive to negative pressure was made. The principal point raised was whether you leave too much bearing in the median line in case of a hard palate.

Another point that came up in my mind was, in massaging a great many mouths to develop peripheral contour, I found a tissue which even the hardest kind of a pull or hardest kind of manipulation would not register sufficiently in the soft compound.

Otherwise, I think the technic is far ahead of the full compound as far as developing a careful and scientific distribution of the pressure of the denture on the ridges is concerned. The only way I have been able to overcome the varying pressure on an all-compound technic I have been using was as follows: After the impression was seated the second time, I removed and chilled it and then cut longitudinal grooves in the palatal portion where surface appearance of the compound showed excessive pressure and released just that section; by pressing up very, very hard. I would get an impression that would depend, of course, on the intelligent reading of the compound markings, to release gradually the pressure to a point as shown by the sharpness or lack of

sharpness of the markings to the desired pressure.

This other way, I think, is much more delicate except for the one thing that I questioned, which I should think you would have to correct by putting a narrow relief over the excessively hard spots.

*Dr. Stansbery, (closing):* To answer Dr. Smedley's question about the removable tissue, I will just read what I have said: "A ridge with a roll of soft, spongy tissue along its crest, which would permit of a *much better foundation if this tissue were removed,* should be operated on."

Referring to Dr. Smedley's two patients, who were sisters, I had two patients who were sisters. One of them came to me and said, "My sister's teeth look wonderful. Why can't you make teeth look that way for me?" The sister was good looking; and I said, "If you like your sister's teeth why don't you wear them?" She said, "I couldn't do that, could I?" I said, "Why not?" She said, "Aren't our mouths different?" "Yes, they are different and they will always be different, so you can never appear the same."

I don't believe there is any such thing as holding up one successful case in comparison with an unsuccessful case.

Dr. Smedley questioned the elasticity of the tray. I will iilustrate. As shown in Figure 3, here is the ridge; here is the elastic bar, and this is indicated by a dotted line. It took 10 pounds to bring it to that position. However, had that bar been twice as rigid, the 10 pounds would only have put it in a position midway between the straight and the curved lines. But no matter what position it is in, it is the pressure given it that counts. The tray would not be pressed up so far but that when it is released the initial pull would be equal to the force required to place the point where it begins its rebound.

I don't believe the ideal of dentistry can be too high, and when you begin to let down the bars and say, "Well, of course, this isn't just right but we will scrape it here and there," you are in the realm of guesswork; and when you do that, you are not living up to the ideals that every dentist should have. I don't believe in scraping models if there is a more accurate way. Of course, if it were the best way, I would certainly believe in it.

Dr. Chappelle's point on the expansion of tissue is well taken. I thought at first that perhaps he was in error as to the time the hole was left uncovered and covered. It is first pressed up without being covered, and while it is held up in this position, the perforation is sealed and the pressure is released, maintaining the seal that brings about the suction. It is true that this suction will cause a greater rise in the soft tissue, which has greater expansibility than you find in the hard tissue along the median line. It will cause some relief throughout. This is not a method whereby the plates will be made permanent and the mouths never change. I can see no harm, in cases so obviously hard and unyielding, in outlining them by using a little relief. I would much prefer the relief method employing tinfoil rather than the arbitrary method of scraping.

# TECHNIC INVOLVED IN MEASURING DESTRUCTIVE CHANGES OF INVESTING TISSUES OF THE TEETH*

By F. V. SIMONTON, D.D.S., San Francisco, California

WE have found the accurate measurement of detachments in pyorrhetic conditions a difficult task, particularly when records of the extent of the destructive changes are to be used in research. Yet accurate and reliable determination of the position of the line of detachment and its possible advance or retrogression is fundamental to any scientific study of the possibilities and results of treatment. The position of the line of detachment is our most important criterion. Flow of pus, when it exists, can often be readily overcome, in a variety of ways. The assumption that the cessation of such a flow is indicative of the merit of a purported cure is unwarranted. Congestive conditions can be readily overcome; loose teeth can be rendered firm; but the underlying fundamental questions remain. Where is the line of detachment? How far has it advanced? Is it continuing to advance and, if so, how rapidly? Is reattachment taking place?

We believe that the measurement of depths of pockets either instrumentally or roentgenographically, or both, represents the only satisfactory criterion of the existence and extent of pyorrhea. Evidence to the contrary notwithstanding, the truth of this statement was strongly impressed on our minds sometime since when a medical confrére directed our attention to three patients whom he believed immune to pyorrhea. To our preliminary inspection, the mouths of these three men did indeed appear strikingly similar and entirely free from any obvious evidences of pyorrhea. On examining the investing tissues by exploration with periodontometers, however, we found that one case was hopelessly involved, another considerably involved and the remaining case normal. As a result of such experiences, we are convinced that the essential clinical method of diagnosis in pyorrhea rests upon the measurement of detachments and roentgenography.

Before we are justified in drawing conclusions concerning the results of treatment as based upon these measurements, it is necessary to determine the possible factor of error involved in the technic of making such measurements.

It would obviously be false and misleading if a claim of regeneration or reattachment were based upon the evidence that, after a certain period of treatment, a detachment measured 5 mm.; whereas, previous to treatment, the corresponding detachment measured 7 mm., provided the operator who made these measurements was liable to a personal factor of error of 2 or more millimeters. If such were the case, the difference in the two measurements is meaningless, for the same operator might have taken measurements in the identical case on two successive days, and, because of the per-

*From the California Stomatological Research Group (Dental Section).

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sonal factor of error, have obtained two measurements differing by 2 or more millimeters; whereas, the case itself had not changed one whit. It is quite obvious that many of us may have been deceived by apparent but nonexistent improvements that might be solely the result of a technical factor of error.

Let us clarify and expedite the subject by stating that:

1. We have had abundant evidence of the possibility of error even to the extent of 4 or 5 mm. in the measurement of detachments.

2. In spite of the fact that the instrumental measurement of detachments is open to such a large possibility of error, we believe this method possesses great value *(a)* for the purposes of ordinary practice, because it gives a relative idea of whether detachments exist and if so, whether they are slight, considerable or extensive; *(b)* for research, if properly controlled.

3. The reliability of this method of measuring detachments may be increased if the operator will have roentgenograms of the entire mouth before him to serve as a guide at the time of making the measurements.

4. As a supplemental method desirable in practice and necessary in research, we have devised a roentgenographic standardizing device which makes it possible to reproduce roentgenograms at will under identical conditions of technic.[1]

## PROPER CONTROL OF INSTRUMENTAL EXAMINATION OF DETACHMENTS

In explanation of what is meant by the phrase "proper control" as used above, it may be said that to reduce the human error to the minimum for research application of this technic, we have formulated the following method:

1. Detachments in the given case are measured by an operator of tried skill and great patience and of long experience, preferably ten years; measurements to be made with roentgenograms of the entire mouth before him for his guidance.

2. These detachments are remeasured independently several days or a week subsequent by a second operator of comparable skill and experience, who has not watched measurements being taken by the first operator, the second operator to make similar use of the roentgenograms.

3. The first operator indicates in the rectangles for the various measurements[2] whether the conditions for measurement were favorable or unfavorable, the former by a plus sign, the latter by a minus sign.[3]

4. All measurements marked with the minus sign, together with all on which the two operators do not closely agree are discarded and the balance accepted as reliable.

## TEST EXAMINATIONS

The following data are representative of the results that we obtained in our study of the reliability of instrumental measurement of detachments. It is upon the basis of such data that we formulated the research method just given. Incidentally, these data and the idea of test or check measurements may be of interest to teachers of periodontia, for there is no more salutary method of acquainting students with the difficulty of making these measurements and the need for care and practice than that of requiring them to check one another's measurements.

Table 1 represents the measurements of detachments of one case, (37797) by three different operators, one of whom took measurements twice. The operators were senior students who had been

1. Simonton, F. V., et al.: Roentgenographic Standardization, with Special Reference to Pyorrhea Research; to be published.

2. These rectangles are shown on a chart described in "Examination of the Mouth With Special Reference to Pyorrhea." (F. V. Simonton, et al.)

3. Difficulties such as those described in the latter part of this paper might constitute such unfavorable conditions.

selected from the best in the class for their intelligence and skill, to assist us in our clinical dental studies.

To save space, only the detachments on the several surfaces of the teeth of one side of one arch are presented here.

COMMENT

We found Student 1 to be the most accurate of the three, and Student 2 the least accurate.

In a study of the figures in the first two columns of measurements and re-

TABLE 1.—RESULTS OF TESTS BY STUDENTS

| Student 1 | Student 1 | Student 2 | Student 3 |
|---|---|---|---|
| 11/18/23 | 12/9/23 | 11/25/23 | 11/16/23 |
| 1 Upper Left | | | |
| Mesial 4 | 3 | 5 | 3 |
| Distal 6 | 4 | 6 | 5 |
| Labial 2 | 2 | 1 | 2 |
| Lingual 3 | 3 | 3 | 4 |
| 2 Upper Left | | | |
| Mesial 7 | 4 | 8 | 8 |
| Distal 7 | 6 | 6 | 7 |
| Labial 2 | 2 | 2 | 2 |
| Lingual 4 | 5 | 5 | 4 |
| 3 Upper Left | | | |
| Mesial 6 | 4 | 5 | 6 |
| Distal 4 | 4 | 5 | 6 |
| Labial 2 | 2 | 2 | 2 |
| Lingual 4 | 4 | 4 | 4 |
| 4 Upper Left | | | |
| Mesial 4 | 4 | 5 | 5 |
| Distal 4 | 4 | 5 | 4 |
| Buccal 2 | 2 | 3 | 2 |
| Lingual 3 | 3 | 4 | 4 |
| 5 Upper Left | | | |
| Mesial 4 | 4 | 3 | 4 |
| Distal 4 | 2 | 4 | 4 |
| Buccal 3 | 1 | 2 | 2 |
| Lingual 2 | 3 | 2 | 4 |
| 6 Upper Left | | | |
| Mesial 4 | 4 | 7 | 5 |
| Distal 5 | 6 | 6 | 7 |
| Buccal 5 | 5 | | 5 |
| Lingual 5 | 5 | | 6 |
| 7 Upper Left | | | |
| Mesial 5 | 4 | 6 | 6 |
| Distal 6 | 2 | 3 | 5 |
| Buccal 2 | 3 | 2 | 2 |
| Lingual 1 | 2 | 2 | 1 |
| 8 Upper Left | | | |
| Mesial 6 | 2 | 3 | 5 |
| Distal 0 | 0 | 4 | 3 |
| Buccal 2 | 2 | 3 | 3 |
| Lingual 2 | 2 | 3 | 2 |

measurements by Student 1, the following is of interest:

Greatest discrepancy ..... 4 mm.
Number of times discrepancy of 4 mm. occurs ..... 2
Number of times discrepancy of 3 mm. occurs ..... 1
Number of times discrepancy of 2 mm. occurs ..... 4
Number of times discrepancy of 1 mm. occurs ..... 8
Total number of measurements which agree ..... 17
Total number of measurements which do not agree ..... 15
Percentage of total discrepancy to total of measurements in first column 22.5.

It will be noticed that the larger discrepancies occurred in measurements on posterior teeth where access and vision were most difficult.

The number of agreements is quite noteworthy and, we believe, the result is very creditable considering the inherent difficulties in the technic and the limited experience of the operators.

To compare measurements of Student 1 (first measurements, Column 1) and Student 2 (Column 3):

Greatest discrepancy ..... 4 mm.
Number of times discrepancy of 4 mm. occurs ..... 1
Number of times discrepancy of 3 mm. occurs ..... 3
Number of times discrepancy of 1 mm. occurs ..... 17
Number of times measurements agree ..... 9
Number of times measurements do not agree ..... 21

In this comparison, the greater discrepancies are again found in the measurements of the molar teeth. Although there are relatively, a great number of failures in correspondence of measurements, in most of these the discrepancies are small. Only in four cases are the discrepancies really large.

Table 2 presents measurements by a recent graduate associated with us.

TABLE 2.—MEASUREMENTS BY RECENT GRADUATE

| Patient 37904 | | Patient 37950 | |
|---|---|---|---|
| 1/17/24 | 1/19/24 | 1/18/24 | 1/19/24 |
| 1 Upper Left | | 1 Lower Left | |
| Mesial 5 | 4 | Mesial 2 | 3 |
| Distal 4 | 3 | Distal 2 | 3 |
| Labial 0 | 1 | Labial 2 | 2 |
| Lingual 2 | 0 | Lingual 2 | 2 |
| 2 Upper Left | | 2 Lower Left | |
| Mesial 3 | 2 | Mesial 2 | 3 |
| Distal 2 | 0 | Distal 2 | 4 |
| Labial 0 | 1 | Labial 0 | 1 |
| Lingual 0 | 1 | Lingual 2 | 2 |
| 3 Upper Left | | 3 Lower Left | |
| Mesial 0 | 0 | Mesial 2 | 3 |
| Distal 3 | 3 | Distal 0 | 0 |
| Labial 0 | 0 | Labial 0 | 2 |
| Lingual 1 | 1 | Lingual 0 | 2 |
| 4 Upper Left | | 4 Lower Left | |
| Out | | Mesial 2 | 0 |
| | | Distal 0 | 2 |
| | | Buccal 0 | 0 |
| | | Lingual 1 | 1 |
| 5 Upper Left | | 5 Lower Left | |
| Mesial 3 | 2 | Out | |
| Distal 2 | 2 | | |
| Buccal 0 | 2 | | |
| Lingual 1 | 2 | | |

| Patient 37904 | | | Patient 37950 | | |
|---|---|---|---|---|---|
| | 1/17/24 | 1/19/24 | | 1/18/24 | 1/19/24 |
| 6 | Upper Left | | 6 | Lower Left | |
| | Out | | | Out | |
| 7 | Upper Left | | 7 | Lower Left | |
| | Mesial 1 | 2 | | Mesial 3 | 2 |
| | Distal 0 | 3 | | Distal 4 | 4 |
| | Buccal 2 | 2 | | Buccal 4 | 4 |
| | Lingual 2 | 1 | | Lingual 1 | 3 |
| 8 | Upper Left | | 8 | Lower Left | |
| | Mesial 0 | 3 | | Out | |
| | Distal 0 | 2 | | | |
| | Buccal 2 | 2 | | | |
| | Lingual 0 | 2 | | | |

There is a more general lack of correspondence in these figures than in those of Table 1, showing either that the cases were more difficult, or, more probably, that the operator was less careful and less skilful. It is apparent that an operator should be carefully tested before too much reliance is placed on his data.

Table 3 presents data from studies of measurements by an operator of ten years' experience, unusually painstaking and possessed of great skill.

| Patient 37854 | | | |
|---|---|---|---|
| | | 11/25/23 | 12/9/23 |
| 1 | Lower Left | | |
| | Mesial | 12 | 12 |
| | Distal | 8 | 9 |
| | Labial | 6 | 6 |
| | Lingual | 6 | 6 |
| 2 | Lower Left | | |
| | Mesial | 9 | 9 |
| | Distal | 8 | 9 |
| | Labial | 6 | 5 |
| | Lingual | 5 | 5 |
| 3 | Lower Left | | |
| | Mesial | 8 | 8 |
| | Distal | 2 | 2 |
| | Labial | 4 | 3 |
| | Lingual | 3 | 3 |
| 4 | Lower Left | | |
| | Mesial | 1 | 2 |
| | Distal | 4 | 2 |
| | Buccal | 3 | 3 |
| | Lingual | 3 | 3 |
| 5 | Lower Left | | |
| | Mesial | 3 | 4 |
| | Distal | 2 | 3 |
| | Buccal | 3 | 2 |
| | Lingual | 3 | 3 |
| 6 | Lower Left | | |
| | Out | | |

PATIENT 37854

| | | 11/25/23 | 12/9/23 |
|---|---|---|---|
| 7 | Lower Left Out | | |
| 8 | Lower Left | | |
| | Mesial | 3 | 4 |
| | Distal | 3 | 3 |
| | Buccal | 4 | 4 |
| | Lingual | 4 | 4 |

The correspondence is remarkably close. Only once does a discrepancy greater than 1 mm. occur.

From these studies, it is evident that the correspondence of a series of measurements is often fairly close, depending, however, on the case and the operator. Much can be learned from these measurements, but it must be clearly borne in mind that carelessness may easily render them worthless. The exercise of good judgment in gaging the degree of reliability of particular measurements and of series of measurements in relation to the purpose for which they are to be employed is very important.

## DIFFICULTIES TO BE CONSIDERED IN MEASURING DETACHMENTS

The technic of measuring detachments, as presented briefly in a paper entitled "Examination of the Mouth—With Special Reference to Pyorrhea," would seem, on casual consideration, a very accurate one. The present paper makes it clear, however, that great care is necessary to prevent errors.

*Determination of the Gingival Line.*—It is often difficult and sometimes impossible to determine the position of the gingival line. In certain cases, the presence of dental operations or the existence of caries or erosion destroys the landmarks, and arbitrary positions must be assumed. These arbitrary positions may sometimes be judged with considerable accuracy when enough of the tooth remains. In other cases, the best assumed position is merely a guess.

The gingival line is not so well defined in certain positions as it is in others. For example, we have found the gingival lines of the mesial and distal surfaces of bicuspids and molars generally less distinct than on, say, the mesial and distal surfaces of the upper anterior teeth. The tactile sensations conveyed by the explorer passing over enamel and cementum, respectively, are not always sufficiently different to enable the operator to be certain of his position.

*Determination of Line of Detachment.*—Certain errors are possible in locating the line of detachment or the bottom of the pocket. A mass of calculus interfering with further passage of the instrument as it slides along the root may be mistaken for the bottom of the pocket. Again, insufficient force may be exercised and the instrument may not reach the bottom; or too much force may be used, and tissue may be stripped from the root. We endeavor to avoid the latter, measuring pockets lightly but firmly.

*Determination of Amount of Detachment.*—There is the possibility, especially in examinations in the posterior part of the mouth, of passing the subgingival explorer obliquely along the root of the tooth rather than in a direction parallel to the long axis, thus giving a measurement which is too long.

*Fatigue.*—The making of a number of measurements of this kind with great care is tedious and it is to be expected that there will be a tendency to less precision in measurements made toward the close of a sitting. It may be desirable to rest or defer later measurements to a subsequent sitting, should fatigue ensue.

# THE FOUNDATION OF ORAL HYGIENE

By ALFRED OWRE, D.M.D., M.D., C.M., B.A., Minneapolis, Minnesota

(Read before the American Academy of Periodontology, Cleveland, Ohio, Sept. 7-8, 1923)

IF periodontology were composed only or chiefly of the mechanics of its craft, this group as an "academy" would have small reason for existence. As you know, however, the technic of periodontia is only the curative therapeusis of troubles that have their roots in systemic diseases of various kinds, often obscure in their origin and difficult of diagnosis. Your specialty, therefore, is an important and exacting branch of the healing art. It has need of all the general knowledge it can lay hands on regarding fundamental bodily conditions and processes. Ideally, it requires the full medical education of the diagnostician plus a subsidiary, though indispensable, training in technic.

I have been asked to speak on any phase of personal health that I choose. As you know, I have never engaged in any specific problem of scientific research outside the field of metallurgy, and can bring you no findings of my own. Ever since I left the medical school, however, I have been deeply interested in the problem of general health and its relation, especially, to oral conditions, and have made an unremitting study of it from a philosophic standpoint. In nearly thirty years of reading, personal experiment and first-hand observation of various peoples, I have come to some clear-cut conclusions, which I shall try to present to you.

One conviction, which I am by no means alone in holding, is the hopelessness of lessening the physical ills of the world by curative means. Unless Nature has done worse by us than seems at all probable in any rational scheme of affairs, there must be underlying principles of health that we must discover and practice if the human race is to endure. Mere palliative measures, valuable as they are, cannot out-march the diseases and the physical degeneration of civilized man. It does not need an alarmist to recognize the depressing nature of modern health conditions throughout much of the civilized world. Let me cite a typical illustration. In March, 1920, the *Manchester Guardian* had an article on "The Nation's Health" in which it was stated authoritatively that army drafts revealed that only three men of every nine examined—and that, remember, included only the young and early middle-aged—were really fit. Taking into consideration the fact that these figures "cover the period between November, 1917, and October, 1918 . . . when the age for service was high, and when the pick of adventurous youth had voluntarily joined the army, the fact remains that, out of two and one-half million men examined, only one-third were 'fit'. Of the other six in the nine, two were 'definitely infirm'—three were capable of only a moderate amount of physical exertion—were almost, for their age 'physical wrecks,' and one was a 'chronic invalid.'"

So alarming was the situation in England that, in May of the same year, a two and one-half day conference of physicians, teachers, dentists, social workers, members of parliament and others interested in the general welfare was called at Manchester by the Food Reform Society to consider means of remedying conditions. The keynote of

the whole gathering was prevention. It was recognized that curative means alone were hopelessly inadequate to quell the rising tide.

Conditions in the United States as revealed by the army draft are depressingly similar. To men of the medical profession, getting at the root of this matter would seem a foremost patriotic as well as a humanitarian duty. So much for the situation. I do not need to adduce further evidence for this group. Your daily contact with humanity will confirm my statements. As Mary Foote Henderson[1] writes: "The human race is ill . . . and the world, which is a paradise, but by men converted into a hospital, is seen and judged through the eyes of an invalid."

As to the remedy, it is, of course, complicated, but less so I believe, than would seem at first. While it is impossible to determine at all exactly the relative parts played by fresh air, sunlight, shelter, clothing and food on a subject of good hereditary stock, I have no hesitancy in stating my belief that by far the most important factor in maintaining health is proper food. It is so obvious a fact that a delicate engine like the human body can do its best only on such fuel as it was built for that we usually overlook it. A gasoline engine will not run at all if fed with coal; yet our bodies, built for simple primitive foods, have so much more marvelous and adaptable a mechanism that they will run for years on a clogging diet of pancakes, waffles, and mince pie before they finally break down.

The human digestive mechanism has changed little since the days of the apeman. Biologists seem agreed that its evolutionary changes are practically at an end. Yet, think for a moment on primitive as contrasted with civilized diet. Evolving man, as we know, had to forage for his food. It consisted, as Sutherland[2] points out, of such seeds, fleshy roots, fruits, green leaves, and mushrooms, seaweed, bark and grains on the vegetable side, as he could wrest from a hostile world, all of them uncultivated, and of whatever primitive animal food he could procure, such as fish, mussels, lizards, snakes, frogs, snails, birds, birds' eggs, insects, caterpillars and other tempting creatures. For sweets, he had honey. In common with other animals, he had a tendency to seek out food of the most concentrated, the most digestible and the most palatable kind. As Sutherland further indicates, all the changes that the diet of our ancestors has undergone since presimian times are traceable to the fact that man seeks out concentrated, digestible and delicately flavored foods in preference to foods that are bulky, indigestible and acrid.

It is these instincts, plus the ingenuity of civilized man, that have combined to undo us. We have devised finer and ever finer flours, more and more highly concentrated foods, more and more complicated dishes, in response to our instinctive demands. Meanwhile, we have ignored the needs of our system, still practically like that of our primitive ancestors, for bulky foods, for "green" foods, for simple foods. Also we have gotten away from the largely herbivorous diet of the primate, to a fare increasingly rich in animal foods, especially meats. Colonel McCarrison[3] of the British Army conducted, not long ago, an interesting series of experiments in India on a group of monkeys. He took these animals from their natural habitat and experimented with various refined and modified foods, much of it tinned. In every instance, diseases of the digestive tract, such as constipation, diarrhea, ulcers—in short the whole train of civilized ills—were quickly induced.

The worst direct result of our modi-

1. Henderson, Mary Foote: The Aristocracy of Health.

2. Sutherland, G. A.: A System of Dietetics.

3. McCarrison, Robert: Studies in Deficiency Disease.

fied diet has been the increase of constipation, with all of its attendant ills. The number of adults throughout the civilized world who have to depend to an increasing extent, on drugs and mechanical aids for the elimination that should come naturally, I venture to say far exceeds the number who do not. Figures in England, for instance, where the diet of the working classes is so largely tea and fine flour products, are appalling. Mouth conditions, as you well know, are equally bad. Indeed, it has always been my observation that eliminative disorders and dental diseases go hand in hand. For that matter, constipation, I believe, breeds the majority of human ills. Prevent this evil by rational diet, and you build up a resistance that defies most germs and quickly throws out those that do gain a foothold.

The diet I have found, by many years of testing, to be best for this purpose is practically meatless. This is chiefly on the ground that meat, at best a quickly decomposing substance, has to pass through, in the human body, about 30 feet of intestine; whereas, in animals primarily adapted to a meat diet, it traverses only about 15 feet. This is an inverted way of saying that our system is ill-adapted to meat foods. Moreover, it is highly important, as Haig[4] demonstrates, to keep on a diet as free as possible from uric acid. Meat is one of the chief sources of this disturbing factor. For the protein elements, I rely chiefly on milk, cheese, white of egg, curds and nuts.

I depend largely on fruits, fresh vegetables and salad plants. The fruits serve a fourfold purpose. They give bulk, thus furnishing a bolus for the action of the intestine. When taken before meals, they prevent overeating of more concentrated foods. They furnish sugar in its most digestible and valuable form (you are familiar with the bad effects of "free" sugar). They supply liquid, and, in many cases, furnish vitamins.

The vegetables, again, furnish bulk, some nutriment and water. The salad plants, especially lettuce, are chiefly valuable for the indispensable vitamins they furnish.

This program further embodies the value of whole grain. Breads made from whole wheat, whole rye, etc., do not clog the intestines; they leave us the vital elements present in the outer layers of the grains. Coarse breads made from whole grains, with no cakes or pastries, should be the rule.

A point I cannot emphasize too strongly is the necessity for eating only what we need. Most people are overfed; and, sooner or later, some organ breaks down under the strain. It is a fairly easy matter to ascertain the number of food units, or calories, a person of given weight requires, and to plan a balanced and wholly satisfying diet on the principles I have outlined. Experience has taught me that, having done this, it is much better to take this standard amount of food in two meals instead of three. This gives the digestive tract a much-needed rest between shifts. It prevents the heavy, dull period that otherwise follows a midday luncheon. It insures one, moreover, a uniformly keen appetite for the meals he does eat.

To summarize, the one thing necessary is attention to the digestive tract. Ancient civilizations were better aware of this than we are. The Egyptians were excellent hygienists; they concentrated their attention largely on the digestive system. The Grecians, still our light in great undertakings, made noteworthy observations on food in relation to hygiene. The ideal diet described in Plato's "Republic"[5] is probably the climax of achievement in this field up to this point. "And with such a diet they may be expected to live in peace and health to a good old age, and bequeath

4. Haig, K. G.: Health Through Diet. A Practical Guide to the Uric Acid-Free Diet.

5. Plato's Republic, Book 2.

a similar life to their children." Curative work (although necessary) will in the near future be referred to as incidental.

General and medical literature has ever since had numerous references to the evil effects of an incorrect diet and the good to be had from an ideal program. I am tempted to quote a few modern writers on the subject in order to substantiate my strong belief that with this one weapon we shall be able to combat many systemic diseases almost single-handed.

I cannot help believing that medical curative treatment will, by and by, resolve itself in great measure into modifications of the food, swallowed and breathed, and of the natural stimuli, and that less will be expected from specific and noxious disturbing agents, either alien or assimilable. The noted mineral waters containing iron, sulphur and carbonic acid supply nutritious or stimulating materials to the body as much as phosphate of lime and ammoniacal compounds do to the cereal plants. The effects of a mild and vegetable diet, of gluten bread in diabetes, of cod liver oil in phthisis, even of such audacious innovations as the water-cure and the grape-cure, are only hints of what will be accomplished when we have discovered what organic elements are deficient or in excess in a case of chronic disease and the best way of correcting the abnormal condition, just as an agriculturist ascertains the wants of his crops and modifies the composition of his soil. In acute febrile diseases, we have long ago discovered that far above all drug-medication is the use of mild liquid diet in the period of excitement, and of stimulant and nutritious food in that of exhaustion. Hippocrates himself was as particular about his barley-ptisan as any Florence Nightingale of our time could be.

The generation to which you who are just entering the profession belong, will make a vast stride forward, as I believe, in the direction of treatment by natural rather than violent agencies.[6]

The subject of an ill-chosen diet and its evil effect on the community has been too long shelved by my own profession in this country. Its importance has been too little insisted on to those who depend on us for guidance.

It is not too much to say that diet, rightly understood, is the foundation of all national and individual welfare—that the rise and fall of nations is determined by the circulation in the body and in the brain. It was a saying of Napoleon that every army marched on its stomach, and the same may be said of nations. In the last resort, their commissariat is their success or ruin.

In the first of two editorials on "Food and Feeding," the *British Medical Journal* observed:

> It is unfortunate that the abundance of cheap and varied food has not given us a healthier and better-nourished population, for the wage-earning classes of the present day are notoriously less robust, physically, than they were a hundred years ago; this is true not only of factory workers who live in towns, but of farm laborers and Highland cotters. The present cheapness of dietetic luxuries has proved an evil; cheap tea and sugar have done disservice to our people, while the relative cheapness of meat, especially tinned meat, has induced a disproportionate expenditure on an article of diet, the dietetic value of which is over-estimated.

*Consumption and Its Cure.*—The most recent official and medical opinion attaches increasing importance to scientific feeding in the years of childhood as among the most effective methods of furthering the campaign against tuberculosis.

Of the 60,000 annual victims of consumption, 11,000 are children and young persons.

"It is possible, and indeed probable," observes Sir George Newman in the first report of the medical department of the board of education, "that phthisis in an incipient stage exists among children to

6. Holmes, Oliver Wendell: Border Lines in Medical Science.

a greater extent than has yet been suspected."

A leaflet issued by the National Association for the Prevention of Consumption remarks: "A knowledge of diet and hygiene would not only help to diminish consumption, but would also tend to improve the general health of the community and stave off other diseases."[7]

Dr. Harry Campbell pointed out that the physical evils resulting from ignorance of the laws of dietetics affect the whole nation from the richest to the poorest, and instanced rickets and defective teeth as among the most serious evils of faulty diet. Statistics show that, of the children in the United Kingdom, only one per cent pass through their first dentition without some diseases of the teeth.

The fact that there must be something in our dietetic habits was borne in on me very strongly when I was in Egypt, where I examined large numbers of Fellahin laborers every week, for I was struck with the extraordinary beauty of their teeth. I feel sure, since they live on hard fibrous material, i.e., largely vegetable and oily in character, and on their corn, which they grind in their own homes, that in their dietary lies the secret of their dental after-health (James Wheatley, M.D.).

The experiences of eminent workers relating to errors in matters of diet are repeated to some degree in millions of their fellow-countrymen. The well-being of a nation is, after all, dependent on the vigor of its component parts; and Ruxley's saying, that care for the digestion means care for the brain, has the most important bearing on national efficiency.

The general intelligence and the success of the Japanese people, who are described as "the most vegetarian race on earth," cannot but be connected with their abstemious habits. Travelers in rural China are almost unanimous in laying emphasis on the extraordinary physical capacity and endurance of her people. In some respects, they are crude, senseless and obstinately conservative, but they have the physical basis of success.[8]

"I have come to the conclusion that more than half the disease that embitters life is due to avoidable errors in diet." (Sir Henry Thompson.)

"It is one of the axioms of physiology that the majority of the diseases of mankind are due to, or connected with, perversions of nutrition." (Professor Chittenden.)

"Food is the point about which turns the whole problem of degeneracy." (Alfred Eicholz.)

"This question of food is one of primary importance, far more than education." (Sir James Crichton-Browne.)

"To lengthen life, shorten meals. Dyspepsia is due, in nine cases out of ten, to too much food, too little exercise."[9]

"The duration of the life of men may be considerably increased. It would be true progress to go back to the simple dishes of our ancestors. . . . Progress would consist in simplifying many sides of the lives of civilized people." (Elie Metchnikoff.)

The only hope of combating successfully the enormous amount of dental disease is by prevention, as any attempt at cure, after this condition has become established, is a hopelessly vast proposition. One of the most important factors in prevention is attention to correct diet.[10]

7. Third Annual Report, 1911.

8. Russell, R.: Strength and Diet.

9. Lubbock, Sir John: The Pleasures of Life.

10. Wallis, C. Doswell: Some Thoughts on the Prevention of Dental Diseases and Irregularity.

# DIET AND ITS RELATION TO CHILDREN

By FRANK J. BABNICK,* Minneapolis, Minnesota

PROBABLY one of the most vital problems confronting the civilized nations today is the maintenance of public health. This is not a problem peculiar to the present generation. It involves a situation that has been combated since the earliest days of civilization. History tells us that the primitive tribes which could best cope with the problem of keeping their individuals in good physical condition emerged as leaders in their struggles for existence and supremacy with neighboring tribes. We need but a glance at the Egyptian, Greek and Roman achievements, and a consideration of the underlying principle of their superiority, to determine that the superior body and mind are the fundamental factors in their achievements. The early civilization along the Nile fell because the Egyptians were overpowered by a superior race inhabiting the Greek peninsula, and Greece fell because, during its era of prosperity, it deviated from its ideal mode of living. This is repeatedly seen throughout the history of man in his struggle for superiority.

If we analyze the life, habits and nutriment of a Spartan, Athenian, Roman, Macedonian, or any other subject of a great race at the time when it was at the zenith of its power, we find that each led a comparatively simple life, with cleanly habits, plenty of outdoor exercise and, above all, a simple diet. These three factors constituted the whole secret of a successful and healthy life, and it is with the latter subject that I intend to deal in the following paragraphs. The subject of diet and its relation to health is a broad one, and I will not attempt to treat it as a whole in a limited space. I am confining my discussion to that part of the life of the individual which is affected to such a great extent by the things that he eats—the period of growth and development.

It seems obvious that the foundation of a healthy and successful life is laid down in early childhood and during the period of adolescence by cleanly habits, outdoor exercise and the right sort of nutriment. All unfavorable hygienic conditions, lack of outdoor exercise, and lack of proper food particularly, bear most heavily on the young individual. They have less resistance than adults. They are more susceptible to infection, and in them the consequences of prolonged underfeeding are much more serious. With adults, underfeeding, if not extreme in degree, even though prolonged, may greatly reduce efficiency without seriously injuring or permanently impairing health. Not so with children. With them the food allowance must not only be sufficient for energy and the repair of waste, but in addition a large allowance must be supplied for growth. Furthermore, there are certain food constituents essential for growth, and unless these are furnished in the food, growth suffers, even though the quantity of food is sufficient. The health, growth and physical development of children and, to a considerable degree, their

*Senior Student Thesis and Seminar Course, 1924, University of Minnesota.

mental development and progress depend on their nutrition.

Nutrition in infancy has been given a great deal of careful study in the last thirty years. The results are marvelous. In New York City, the death rate has been reduced during this period to practically one-third the figure of a generation ago. The average for the last four years is 86 per thousand; in 1880, it was 280 per thousand. This has been brought about by the cooperation of many agencies, among which may be mentioned pasteurization, closer supervision and new standards for the production and handling of the milk supply, cleaner streets, supervision of infants by visiting nurses, a better understanding of the problems of infant feeding and hygiene both by the profession and laity; more rational and more intelligent treatment of infants acutely ill, and many others. Not much of this has been accomplished by legislation. Most of it is the result of educational measures.

Not only has this investigation been going on in our own country but England, Germany, France, New Zealand and Australia also have carried on similar investigations. Dr. E. H. Wilkins, superintendent of school medical service in New Zealand, who has made an interesting study of the deformities found, contends that the extreme rarity of a complete, sound set of teeth and the great prevalence of deformity of the chest are indexes of serious errors in the upbringing of children. The most serious and widespread physical defects found in New Zealand school children are dental caries, faulty development of the jaws and palate, nasal obstructions, adenoids and enlarged tonsils and rachitic deformity of the chest. These defects are due to the same fundamental causes, which can easily be removed; therefore, the vast majority of these diseases and defects from which children suffer are readily preventable. The causes are errors in nutrition, consisting in (1) the unnatural softness of the food; (2) deficiency in vitamins and (3) deficiency of salts.

Insufficient expansion of the upper jaw results in a narrow high arching of the palate, which is accompanied by narrowness and poor expansion of the nostrils, and deflection of the septum. The consequent tendency to nasal obstruction results in deficient ventilation and a moist catarrhal state of the nasal passages. This increases mouth breathing. Both of these factors cause an unnatural moist and sodden state of the nasal and postnasal mucous membrane. This is admittedly a cause of chronic enlargement, analogous to exuberant granulations in a discharging wound; hence, the polypoid overgrowth of the pharyngeal tonsil that we call adenoids.

It is a clinical fact that removal of adenoids and the establishment of nasal breathing tends to rectify underdevelopment of the jaw; but underdevelopment of the jaw, due to deficient masticatory exercises, is the primary condition.

Irregularities of the teeth increase the tendency to the retention of food in the interdental crevices, and, therefore, increase the tendency to dental caries. Mouth breathing, by causing dryness of the gums and teeth and annulling the cleansing action of saliva, also increases dental caries. Faulty development of the jaws, being the cause of both dental irregularity and mouth breathing, is, therefore, in two ways, a cause of dental caries.

If, therefore, poor jaw development is directly and indirectly the cause of these evils, what is the cause of poor jaw development? It is due chiefly to the first of the three dietetic deficiencies mentioned above—the unnatural softness of food. Lack of vigorous mastication, especially in the early growing years of the child, results in the poor development of the muscles of mastication, with consequent poor development of the bones to which they are attached. The pull of the masseter muscle in vigorous mastication un-

doubtedly has a widening effect on the lower jaw, and the actual biting force of mastication must tend to spread and widen the arch of the maxilla and palate. The pterygoid plate of the ethmoid is in close relation to the lateral walls of the nasopharynx and to the palate bone which form the outer walls of the posterior part of the nostrils. The outward pull of the pyterygoids would seem to have a widening effect on the nasopharynx and the posterior part of the nose, the parts that are so frequently narrowed and obstructed. Therefore, vigorous exercise of the jaws in masticating hard food contributes, in more ways than one, to well-developed jaws, a wide arch of the palate and wide and roomy nostrils and nasopharynx.

The softness of modern food, especially children's food, is one of the most obvious departures from the natural in modern diet. This condition operates from about 12 months of age and continues throughout the period of growth. Surely, the lack of this most natural exercise, for which every child shows a most obvious craving, during a period most sensitive to habit and environment, is likely to have some marked developmental effect on the structures concerned.

The primary developmental error seems to be not in the nose, not in the palate, but in the jaws. The jaws are undersized; no part of the nasal structure is undersized, it is simply unexpanded. Surely this proves indisputably that the jaw condition is primary, and that this is due to improper exercise of the jaws. There is a serious developmental flaw in the modern child's jaw that fails to bring the individual teeth of the second set into proper position.

Most of our foods are deficient in vitamins and mineral salts. Meat contains practically no lime. Wheat, whole rice, barley and maize are valuable sources of vitamins and salts, but in the artificially refined and partial state in which they are now eaten, as white flour, polished rice, corn flour, and pearl barley, they are deprived of their germ and outer layers, and so lose all of their vitamins and 50 per cent of their salts. In the common method of boiling vegetables, an average of 40 per cent of their potash and other salts is thrown into the sink. By carelessly allowing the vegetables to cook for a long time, their vitamins are to a great extent destroyed. The vitamins of the fruit in jam are completely devitalized by the prolonged cooking to which they are subjected. The same applies to sugar, which is chemically pure, and therefore a highly deficient and unbalanced food. Oatmeal, milk and its products, fruit and honey, are valuable for the vitamins and salts that they contain.

With regard to mineral nutriment, Bunge says that lime and iron salts are those which are likely to be insufficient in ordinary diets. Sherman, of Columbia University, says that the usual diet is frequently deficient in lime. These deficiencies are calculated in terms of adult requirements of calcium, but the growing child, whose bone and teeth are in the process of calcification, requires more calcium in proportion to its weight than does the adult. Hence, to the child this deficiency is more serious.

The principal foods of children in this country are cow's milk, manufactured sugar and sweets, soft white bread and finely milled flour in biscuits. Cow's milk is natural food for the toothless young only. It is not the food for healthy children with teeth. Manufactured sugar, in 1913, was a moderate article of diet. The consumption of refined sugar, which is never grown here, had gone up per head of population from 9.91 pounds in 1883 to 52.23 pounds in 1900. At the present time, the number of pounds consumed per head is considerably higher. Prior to this invasion of sugar, our children made their own sugar out of starch in such foods as bread and potatoes. There is all the

difference between the native sucking and chewing of fibrous cane and the consumption of the concentrated article in the sugar bowl. Soft white bread and fine flour biscuits are a curse to children. It is most important to note that during the war children got on quite well without any white bread or fine flour biscuits, very little sugar or sweets and much less milk.

Dr. McCollum, one of the best known authorities on diet, writes:

> Malnutrition is not, as many have hitherto believed, ordinarily the secondary result of those physical defects which the clinic seeks to remedy, but it is the primary cause from which those physical defects generally arise. Furthermore, the present widespread view that the most important task in hand is the medical treatment of those children in whom clinically discernible defects exist is a mistaken one. First in importance from both the standpoint of the physically defective child and that of the national welfare is the establishment of nutritive conditions which are regulated as nearly as possible with the scientific precision necessary to insure optimal well-being. The clinic should occupy second place in the scheme of human betterment.

Since malnutrition produces deficiency diseases and the right kind of nutriment develops healthy individuals, is it not our duty and our obligation to future generations to place these facts before the parents for the betterment of the growing young? It has been suggested that the following remedies be put into effect to bring about more desirable conditions: Reform the diet at once. Give the children three meals and nothing between meals. Give them coarse whole meal bread and no sweets at all. Finish each meal with something cleansing, such as dry toast and butter, crust of bread and butter or margarine, celery or fruit. Give the children a piece of apple after the last meal to cleanse the mouth for the night. Spoil them with fruits and toys but never with sweets.

A feasible plan would be to coordinate the work of the children's welfare committees with that of the school authorities, making it possible for those under school age to be treated by the school dental officers.

# REPORT OF THE TABULATION COMMITTEE

**RESULTS OF TABULATION OF STATE BOARD REPORTS FOR GRADUATES YEAR 1924**

| State | College | Total Number of Graduates | Total Number Examined | Examined and Passed | Examined and Failed | Percentage of Failures | Number States Examined In |
|---|---|---|---|---|---|---|---|
| California | University of California College of Dentistry | 91 | 78 | 75 | 3 | 3.8 | 2 |
| | College P. & S. Dental Department | 48 | 48 | 44 | 4 | 8.3 | 2 |
| | University of Southern California College of Dentistry | 116 | 102 | 101 | 1 | 1. | 1 |
| Colorado | Colorado College of Dental Surgery | 38 | 33 | 29 | 4 | 12.1 | 2 |
| District Columbia | Howard University Dental College | 40 | 25 | 19 | 6 | 24. | 8 |
| | Georgetown University Dental Department | 26 | 25 | 21 | 4 | 16. | 8 |
| | Geo. Washington University Dental School | | | | | | |
| Georgia | Atlanta-Southern Dental College | 87 | 86 | 85 | 1 | 1.2 | 7 |
| Illinois | Chicago College of Dental Surgery | 117 | 98 | 96 | 2 | 2. | 9 |
| | Northwestern University Dental School | 186 | 153 | 144 | 9 | 5.9 | 18 |
| | University of Illinois College of Dentistry | 69 | 57 | 55 | 2 | 3.5 | 4 |
| Indiana | Indiana Dental College | 83 | 80 | 69 | 11 | 13.8 | 6 |
| Iowa | State University of Iowa, College of Dentistry | 68 | 68 | 65 | 3 | 4.4 | 1 |
| Kentucky | University of Louisville College of Dentistry | 28 | 27 | 27 | | | 4 |
| Louisiana | Loyola University School of Dentistry | 12 | 11 | 10 | 1 | 9.1 | 3 |
| | Tulane University School of Dentistry | 30 | 29 | 29 | | | 1 |
| Maryland | Baltimore College of Dental Surgery | 99 | 88 | 61 | 27 | 30.7 | 16 |
| | University of Maryland School of Dentistry | 129 | 118 | 98 | 20 | 16.9 | 8 |
| Massachusetts | Tufts College Dental School | 72 | 53 | 45 | 8 | 15.1 | 6 |
| | Harvard University Dental School | 115 | 107 | 107 | | | 1 |
| Michigan | University of Michigan College of Dental Surgery | 79 | 67 | 60 | 7 | 10.4 | 1 |
| Minnesota | University of Minnesota College of Dentistry | 86 | 67 | 65 | 2 | 3. | 8 |
| Missouri | Kansas City-Western Dental College | 29 | 28 | 26 | 2 | 7.1 | 2 |
| | Washington University School of Dentistry | 69 | 67 | 60 | 7 | 10.4 | 10 |
| | St. Louis University School of Dentistry | 32 | 30 | 28 | 2 | 6.7 | 2 |
| Nebraska | University of Nebraska College of Dentistry | 29 | 28 | 26 | 2 | 7.1 | 8 |
| | Creighton University College of Dentistry | 260 | 259 | 184 | 75 | 29. | 3 |
| New York | New York College of Dentistry | 54 | 53 | 45 | 8 | 15.1 | 1 |
| | University of Buffalo Dental Department | 186 | 174 | 115 | 59 | 33.9 | 2 |
| | Columbia University School of Dentistry | 41 | 38 | 34 | 4 | 10.5 | 4 |
| Ohio | Ohio College of Dental Surgery | 50 | 49 | 49 | | | 1 |
| | Western Reserve University School of Dentistry | 13 | 13 | 13 | | | 2 |
| | Cincinnati College of Dental Surgery | 62 | 58 | 58 | | | 2 |
| | Ohio State University College of Dentistry | 143 | 118 | 79 | 39 | 33.1 | 5 |
| Oregon | No. Pacific College of Dentistry | 142 | 139 | 139 | | | 1 |
| Pennsylvania | University of Pittsburgh School of Dentistry | 64 | 62 | 56 | 6 | 9.7 | 4 |
| | Philadelphia Temple University Dental School | 229 | 198 | 164 | 34 | 17.2 | 9 |
| | University of Pa. School of Dentistry | 48 | 47 | 47 | | | 12 |
| Tennessee | Vanderbilt University School of Dentistry | 21 | 19 | 19 | | | 5 |
| | University of Tennessee College of Dentistry | 94 | 63 | 48 | 15 | 23.8 | 18 |
| | Meharry Dental College | | | | | | |
| | University of West Tennessee Dental Department | 23 | 22 | 21 | 1 | 4.5 | 2 |
| Texas | Baylor University College of Dentistry | 19 | 15 | 15 | | | 2 |
| | Texas Dental College | 37 | 35 | 35 | | | 2 |
| Virginia | Medical College of Virginia School of Dentistry | 158 | 157 | 149 | 8 | 5.1 | 8 |
| Wisconsin | Marquette University College of Dentistry | | | | | | |
| | Total | 3422 | 3092 | 2715 | 377 | 12.2 | |

**SUMMARY**

| | |
|---|---|
| Number of State Board Reports Received | 47 |
| Number of State Board Reports Tabulated | 47 |
| Total Number of Applicants Examined and Passed | 2715 |
| Total Number of Applicants Examined and Failed | 377 |
| Percentage of Failures | 12.2 |

Certified as correct,

H. E. FRIESELL,

T. A. BROADBENT,

Tabulation Committee Dental Educational Council of America

## CUMULATIVE RESULTS OF TABULATING STATE BOARD REPORTS FOR GRADUATES YEARS 1910 TO 1924 INCLUSIVE

| State | College | Total Number of Graduates | Total Number Examined | Examined and Passed | Examined and Failed | Percentage of Failures |
|---|---|---|---|---|---|---|
| Alabama | Birmingham Dental College | 54 | 50 | 38 | 12 | 24.0 |
| California | University California College of Dentistry | 537 | 356 | 341 | 15 | 4.2 |
| | College P. & S. Dental Department | 545 | 279 | 235 | 44 | 15.8 |
| | University Southern California College of Dentistry | 773 | 468 | 440 | 28 | 6.0 |
| Colorado | Colorado College of Dental Surgery | 506 | 475 | 432 | 43 | 9.1 |
| District Columbia | Howard University Dental Depa rtment | 488 | 217 | 153 | 64 | 29.5 |
| | Georgetown University Dental Department | 374 | 282 | 224 | 58 | 20.6 |
| | Geo. Washington University Department of Dentistry | 185 | 137 | 108 | 29 | 21.2 |
| Georgia | Atlanta-Southern Dental College | 526 | 521 | 502 | 19 | 3.6 |
| | Southern Dental College | 362 | 337 | 303 | 34 | 10.0 |
| | Atlanta Dental College | 472 | 441 | 367 | 74 | 16.8 |
| | South Eastern Dental University | 2 | 2 | ..... | 2 | 100.0 |
| Illinois | Chicago College Dental Surgery | 1855 | 1571 | 1321 | 250 | 15.9 |
| | Northwestern University Dental School | 1974 | 1622 | 1430 | 192 | 11.8 |
| | University Illinois College of Dentistry | 537 | 474 | 428 | 46 | 9.7 |
| Indiana | Indiana Dental College | 856 | 828 | 757 | 71 | 8.6 |
| Iowa | State University of Iowa, College of Dentistry | 864 | 825 | 787 | 38 | 4.6 |
| | Drake University College of Dentistry | 32 | 29 | 29 | ..... | ..... |
| Kentucky | University of Louisville College of Dentistry | 598 | 535 | 475 | 60 | 11.2 |
| Louisiana | Louisiana State College Dental Surgery | 6 | ..... | ..... | ..... | ..... |
| | Loyola University School of Dentistry | 77 | 63 | 62 | 1 | 1.6 |
| | Tulane University College of Dentistry | 314 | 247 | 229 | 18 | 7.3 |
| Maryland | Baltimore College of Dental Surgery | 775 | 564 | 392 | 172 | 30.5 |
| | University of Maryland Dental Department | 809 | 666 | 496 | 170 | 25.5 |
| | Baltimore Medical College, Dental Department | 83 | 64 | 43 | 21 | 32.8 |
| Massachusetts | Tufts College Dental School | 1376 | 1201 | 1081 | 120 | 10.0 |
| | Harvard University Dental School | 698 | 543 | 480 | 63 | 11.6 |
| Michigan | University of Michigan College of Dental Surgery | 1186 | 1081 | 1049 | 32 | 3.0 |
| Minnesota | University of Minnesota College of Dentistry | 1084 | 997 | 937 | 60 | 6.0 |
| Missouri | Kansas City Dental College | 514 | 470 | 434 | 36 | 7.7 |
| | Washington University School of Dentistry | 430 | 408 | 393 | 15 | 3.7 |
| | Western Dental College | 456 | 413 | 366 | 47 | 11.4 |
| | St. Louis University School of Dentistry | 803 | 733 | 687 | 46 | 6.3 |
| | Kansas City—Western Dental College | 307 | 273 | 266 | 7 | 2.6 |
| | Barnes School of Dentistry | 82 | 70 | 55 | 15 | 21.4 |
| Nebraska | University of Nebraska, College of Dentistry | 302 | 279 | 269 | 10 | 3.6 |
| | Creighton University, College of Dentistry | 353 | 342 | 323 | 19 | 5.6 |
| New Jersey | College of Jersey City, Dental Department | 57 | 53 | 7 | 46 | 86.8 |
| New York | New York College of Dentistry | 2304 | 2081 | 1484 | 597 | 28.7 |
| | University of Buffalo, Dental Department | 735 | 692 | 541 | 151 | 21.8 |
| | College of D. & Oral Surgery, New York | 1468 | 1367 | 976 | 391 | 28.6 |
| | Columbia University School of Dentistry | 179 | 178 | 118 | 60 | 33.7 |
| Ohio | Ohio College of Dental Surgery | 565 | 490 | 381 | 109 | 22.2 |
| | Western Reserve University School of Dentistry | 558 | 523 | 445 | 78 | 14.9 |
| | Cincinnati College Dental Surgery | 163 | 138 | 99 | 39 | 28.3 |
| | Ohio State Univ. College of Dentistry | 558 | 533 | 491 | 42 | 7.9 |
| Oregon | No. Pacific College of Dentistry | 1080 | 872 | 697 | 175 | 20.1 |
| Pennsylvania | Temple University Dental School | 706 | 550 | 446 | 104 | 18.9 |
| | University of Pittsburgh School of Dentistry | 1051 | 1023 | 998 | 25 | 2.4 |
| | University of Pennsylvania School of Dentistry | 2530 | 1822 | 1467 | 355 | 19.5 |
| | Med-Chi. College Dental Department | 348 | 248 | 176 | 72 | 29.0 |
| Tennessee | Vanderbilt University School of Dentistry | 496 | 462 | 439 | 23 | 5.0 |
| | University of Tennessee College of Dentistry | 202 | 189 | 175 | 14 | 7.4 |
| | University of Memphis Dental Department | 5 | 4 | 4 | ..... | ..... |
| | Meharry Dental College | 609 | 499 | 366 | 133 | 26.7 |
| | University West Tennessee College Dental Surgery | 40 | 28 | 18 | 10 | 35.7 |
| Texas | Baylor University College of Dentistry | 324 | 243 | 213 | 30 | 12.3 |
| | Texas Dental College | 181 | 140 | 116 | 24 | 17.1 |
| Virginia | University College Med. Dent. Department | 32 | 30 | 23 | 7 | 23.3 |
| | Medical College of Virginia School of Dentistry | 251 | 237 | 219 | 18 | 7.6 |
| Wisconsin | Marquette University College of Dentistry | 1003 | 886 | 822 | 64 | 7.2 |
| | Wisconsin College P. & S. | 17 | 17 | 15 | 2 | 11.8 |
| | Total | 36657 | 31168 | 26668 | 4500 | 14.4 |

### SUMMARY

| | |
|---|---|
| Total Number of Applicants Examined and Passed | 26668 |
| Total Number of Applicants Examined and Failed | 4500 |
| Percentage of Failures | 14.4 |

Certified as correct,

H. E. FRIESELL,

T. A. BROADBENT,

Tabulation Committee Dental Educational Council of America.

# DEPARTMENT OF DENTAL HEALTH EDUCATION

## SOME FEATURES OF DENTAL PUBLIC HEALTH ADMINISTRATION

By HAROLD DeWITT CROSS,* D.M.D., F.A.C.D., Boston, Massachusetts

(Read before the American Dental Association, Dallas, Texas, Nov 10-14, 1924)

THE purpose of this paper is to stimulate the dentist's interest in public health work, so that he may be able better to suggest and assist in the particular procedures and policies known to yield the best results in this field.

Public health service has only within recent years begun to give attention to matters of health not dealing either with the immediate preservation of human life or with diseases of such serious aspect as to be the immediate cause of a large percentage of deaths. It is, however, reasonable to believe that in the near future this service will undoubtedly be extended so as to deal more and more with a great many phases of health not heretofore thought of sufficient importance to warrant attention from a public health or organized health department standpoint.

The attention given to health examinations, child welfare work and malnutrition of children as well as the efforts in the field of prevention, notable in which is the prevention of tuberculosis and of heart disease, indicates definitely the trend of this work.

Just as it has been necessary for health departments to devise plans for the control and prevention of epidemics, the betterment of children, the prevention of tuberculosis, etc., so it is believed to be necessary for them to devise and execute plans leading toward the improvement of tooth conditions and to do so along lines that are known to be effective.

It is only here and there that we find any definite and constructive public health administrative attempts made to inform the public as to how to control or prevent the serious condition in which children's teeth are at present. In view of the serious and extensive systemic effects known to be produced in many instances by tooth defects, and considering the knowledge available for avoiding this condition, the situation is rather to be wondered at.

We know that more than forty diseases may be traced directly or indirectly to tooth troubles, and many research workers are trying to devise methods and a technic by which these conditions may be relieved or cured, most of which will probably prove to be disappointments. We are just beginning to realize that while the care of these conditions is a difficult and complicated procedure, their prevention is relatively simple.

Far from advocating the treatment of advanced tooth diseases as a public

*Director. Forsyth Dental Infirmary for Children.

health procedure, I am suggesting that the dissemination of knowledge as to their prevention is a proper one, and that boards of health should for this purpose become posted as to the best means of carrying out all known preventive measures; and also that they should be able to indicate definitely the proper line of action leading to dental hygiene, indicating clearly what is preventive and what is not strictly preventive work, as well as the difference between early curative measures and the later repair, or customary dental procedures.

Dentists are not so well-informed as to what constitutes real preventive or public health work as are physicians, the dental school curriculum giving practically nothing dealing with dental public health or clinic problems, and as the idea of preventive dentistry is quite recent, it is only the dentist who has had exceptional opportunities of observation, or contact with public health work, who appreciates to any extent the public health phase of dentistry, from a preventive standpoint. This is not the fault of the dentist and does not in any way reflect on his technical or professional skill or ability, but it is a point that must be considered when an attempt is made to devise plans of a public health character intended to deal with the prevention rather than the cure of existing dental defects.

In order to bring out more clearly some of the phases of dental public health work, it is necessary to go into some detailed explanation as to the function and differentiation of institutional or clinic dentistry, and that of private practice. It is not intended to convey the idea that the fundamental practices or technic are essentially different, but only their application; and that which may be a necessary and proper policy to pursue in private practice may not be at all suitable for public health work. For one thing, the responsibility that is necessarily a part of a public health dental policy is practically never felt by the private practitioner. There is a vast difference between starting out to accomplish some definite results for a large number of people in a given community or group and merely beginning practice in a community for the few who come to the private office. The public health department is confronted with the necessity of organizing its work and policies in such a way as to accomplish that which is most needed to improve the dental condition of all who by location or condition in life ought to be its beneficiaries; in other words, to do the most good to as large a number of persons as possible. On the other hand, the private practitioner does not entertain any such responsibility, and, while actuated by high professional ideals, doing his work in a proper, creditable and professional manner, he works only for as many individuals as come to seek his services, content if conditions work out so that he cares for few or many, provided his time is profitably occupied, and he has necessarily no particular anxiety regarding the many in his locality or city who do not secure his services.

This condition is recognized by all who have had practical experience in public clinic work, but to the practitioner doing private work exclusively it seems strange. The public health point of view is different; it is broader and more constructive in its desire of accomplishment, and it is to this point of view that preventive dentistry owes much of the incentive of the last few years.

Many localities are anxious to do constructive dental work for their children and desire definite and concise information as to what and how to do these things, and they should not be obliged longer to depend on the hit-or-miss ideas of well-intentioned persons—dentists, physicians, social workers, etc., who have no actual experience or knowledge in this particular field. Communities are ready and willing to expend money but wish to work along sufficiently definite lines to insure reasonable success in ultimate results and

to avoid needless expenditure. As people are now accustomed to obtain authentic information on all matters pertaining to all lines of health from public health officials, it would appear especially desirable that all health departments be able to indicate with detailed exactness just what dental program can be considered preventive and conducive of improvement of children's teeth from the standpoint of a constructive and efficient program.

The reason this is not done has been suggested earlier in this paper: lack of training, knowledge and experience in this relatively new field; a belief that dentists should and do know, and a failure to realize that they do not (because they have had no opportunity to learn), and also, possibly, failure on the part of public health officials to realize that there is a marked difference between the general "orthodox" and customary technical dental practice in adults and the newer ideas and principles of preventive dentistry. Not that the older practices are always wrong or should be discarded so far as private practice or adult work is concerned, but that the two are fundamentally entirely different; that one deals exclusively with established conditions of disease, while the other aims either to prevent entirely or give early attention to the original defect from which practically all tooth diseases in adults originate.

The Forsyth Dental Infirmary's plan involves the following features, and the results have been very satisfactory if we consider end-results or the condition of the child's teeth at the age of 16 years rather than the number and type of operations which have been performed.

1. (*a*) The age at which treatment is begun is such as to permit attention to be given to permanent teeth and primary when possible immediately after eruption (six weeks).
   (*b*) As thorough and lasting operations as possible are performed in simple cavities only—no root canal work or filling of "doubtful" cavities.
   (*c*) Nutrition clinics are established dealing with metabolism, diet, hygiene, absorption, elimination, the endocrines, etc., for young children and infants, and prenatally, to improve the condition of nutrition.

The intermediate goals are (1), 6-year age; (2), 4-year age; (3), 2-year age; (4), 6-months age. The final goal is (5) the prenatal period.

*Results.*—The first permanent molars and other teeth are kept in good condition with only small fillings up through the eighth grade, and a simple yearly follow-up is sufficient, because of thorough or radical removal or poor and weak teeth, and because there are no capped pulps or root-canal work to "go wrong." The cleaning and repair of each pair of teeth as soon after eruption as possible prevents the establishment of extensive or serious diseased conditions. This is really the application of the "end result" feature to dentistry.

The principal administrative features of dental public health involves recommendations with the idea of putting into effect the following items, classified under two headings: I Education; II Technic or policy for clinics: (1) dental and (2) nutritional.

I Education of the Public.
   1. Create interest in the need for good teeth.
   2. Show that
   (*a*) Good teeth are possible.
   (*b*) How good teeth may be made attainable.
   (*c*) Immediate attention to each tooth by a dentist as soon as erupted is needed to control these conditions by a simple repair process (early repair).

(The approximate ages suggested are:

2-4 years, temporary; 6 years, bicuspids; 8-10 years, second permanent molar.) A large percentage of tooth defects are developmental and exist long before the tooth erupts (75 per cent?). Special early treatment visits must be arranged, first, to get the child to the clinic; and secondly, to make available a suitable type of treatment, i.e., silver nitrate in small fillings and radical extraction of diseased teeth. The catching of the explorer point indicates silver nitrate; insertion of the explorer indicates a filling.

(*d*) Attention to nutrition and hygiene, beginning prenatally, is necessary to insure good primary teeth; and attention to the nutrition of the child must begin five or six years before the permanent teeth erupt to produce sound permanent teeth. The importance of protein, vitamins, and calcium and other minerals; the harm resulting from carbohydrate imbalance, resulting for example from consumption of excessive amounts of refined sugar; eating between meals, consumption of too concentrated foods, etc., must be very definitely shown.

(*e*) The mother more than the dentist is responsible for poor teeth or can give good teeth to the child, because teeth are an organ of the body and are developed by food just as are other organs.

(*f*) 1. Brushing has not been conclusively proved definitely to prevent decay of teeth.

2. A clean tooth frequently does decay. (Dentists are remiss in allowing the public to believe the statement that pastes prevent decay.)

3. At best cleaning cannot control defects that begin before the tooth erupts (75 per cent?) or improve an already formed cavity.

The public health worker understands that all public health work must be focused several years in the future, and that the greatest good to the greatest number must always be considered rather than to permit one individual, or a relatively small group of individuals, to absorb the opportunities needed by the many.

II Clinic procedures and policies.

(The following items are to a certain extent a repetition of the educational ones, but are necessary here to carry out the correlation.)

1. The Dental Clinic.

(*a*) Repair the primary teeth early and the permanent teeth immediately after eruption, with the same attention to primary as is usually given to permanent teeth. It is useless to attempt to carry on clinics, or to treat children's teeth in the "orthodox" manner, as no real progress will be made (40,000 dentists versus 40 years). Each year the "new" class of children has as great a percentage of defects as the previous one.

(*b*) Work on preschool or first grade children only for filling of "pits", "fissures" and small cavities. Follow up each year only those treated at preschool or first grade age, as may be determined. Extraction (surgical clean-up) for others if it is desired to give relief to those with seriously diseased teeth.

(*c*) Do thorough and complete work; remove all diseased teeth that cannot be filled and fill for permanency as nearly as possible (no root

canal work, pulp capping or filling of large and deep cavities.) Fill conservatively only those that it is believed will remain satisfactory for at least twelve months.

(*d*) As rapidly as possible, see all cases not later than from 2 to 3 years of age. This, of course, is the limit of age at which actual dental work (early repair) can be done.

2. The Nutritional Clinic.

(*a*) See that medical attention, physical examination and correction of all physical defects possible including endocrine treatment is given if needed. Establish nutrition classes for children up to 12 years of age with especial preference to those from 2 to 4 years. Habit will necessarily be an important phase of all nutritional work for children. It is harder to get people to eat right than to advise them right.

(*b*) Establish baby and prenatal instructive clinics in hygiene and nutrition, habits and food with reference to teeth, especially during the first twelve to fifteen months. Much detail is not needed here as these lines are fairly well understood by those accustomed to this work.

Education used to be the exclusive possession of the privileged few, but when it was brought within the reach of the masses, it had to be altered from the development of high degrees of individuality to fit the needs of large groups of people. So public health dentistry, to be arranged to fit the needs of the masses, requires the application of new policies, in an impersonal but never in a heartless manner, and occasionally the sacrifice of the individual must be made for the good of the many.

It is believed that there is now enough knowledge as to efficient methods and policies needed to produce very definite results in dental public health work; and that public health departments may and should obtain and make available the necessary information as to these policies to such communities as are looking for authentic knowledge as to how to accomplish results. It is only a question of the right kind of cooperation between the dentists and public health departments when as satisfactory results will be accomplished in dental public health as have been attained in other lines of hygiene.

DISCUSSION

*Harris R. C. Wilson, Cleveland, Ohio:* I was pleased to have Dr. Cross say definitely that we should not undertake to fill teeth when there is grave doubt of success. When we are almost certain that a tooth is going to "go bad" in just a short time, why spend our time, and have it abscess and know nothing about it for perhaps a year and have some serious systemic result occur? I think we owe a great obligation to the public to see that we do not do something that makes matters still worse. Therefore, we should remove any tooth that is in such condition. I want to emphasize the idea that we should save all teeth that we can save in a vital, healthful condition. We ought to take care of our children at just as early an age as possible. I am glad Dr. Cross speaks of 2 years as the time to begin our dental care. In one clinic in Cleveland, we have cared for children as young as 16 months. Of course, we have not many of that age, but we feel that the fundamental thing is to get back of our school-age work and see that the children come to school in good condition and do not have to waste a good share of their first year in school with all sorts of troubles that should have been taken care of previously.

*Dr. Cross (closing):* I would like to summarize under four headings some of the points covered: (1) education, (2) nutrition, which is fundamental and (3) the absolute importance of immediate repair work within six weeks, and beginning not later than at 6 years, to do as nearly permanent work as possible with a yearly follow-up until the twelfth year, or the time of eruption of the second molars. If that were done in every community, I am positive that the defects

could be eliminated; that the children would pass from the eighth grade into the high school with teeth that gave every indication of remaining in good condition as long as the individual should live. I think Dr. Thompson stated that "it was simple to eliminate caries," and it is, but you are making it complex, just as the canal treatment of the first permanent molar makes it complex, and everyone has considered it a problem until this simple way of doing it and handling this situation was conceived. At the present time, at the Forsyth Dental Infirmary, we have absolute control of the first permanent molar problem in the schools, but it was quite a difficult matter to get people to believe in this plan. But all that was needed was a chance to get at the first permanent molar six weeks after it was erupted. All of the trouble comes from neglect, and if this policy of early attention can be put into operation in any community, I don't care whether it is city or rural, teeth are teeth, and they are subject to the same physical conditions. The way of going about it will of course need to be modified somewhat, and we have heard this afternoon some very interesting suggestions in regard to this, but the fundamental policy is exactly the same, and we must not forget that the teeth are one of the coordinating organs of the body, and not a separate entity with a body attached as an after-thought.

# NATIONAL CHILD HEALTH DAY*

By ANNA B. TOWSE

MAY Day has been designated as National Child Health Day throughout the country. An appeal has gone out to all citizens of the country to relax from the routine of their daily affairs and turn their attention to the children of the community. May first will be a day of stock-taking. Communities will balance their health liabilities and assets. They will inquire into the health protection that neighboring and remote cities are giving their children. Finally, they will begin constructive work to make their own community a healthier place for their boys and girls. This is the suggestion made by the American Child Health Association, which conceived the idea of a national observance of child health.

Encouraging the promoters of this child health day movement, Herbert Hoover, president of the American Child Health Association, says:

> It is so constructive and offers such broad opportunity for everybody to cooperate that it bids fair to mark a definite step forward in what should be a primary concern of our civilization, the safeguarding of the right of every child to reach maturity in good physical condition.
>
> The appeal is to the finest instincts of the individual and to the enlightened self-interest of the entire community. It is not surprising, therefore, that, in addition to the personal interest aroused among parents, teachers, the medical profession and health authorities, you have secured the practical cooperation of commercial bodies, manufacturers, insurance companies and trade organizations. These groups will be performing a fine public service and will take a high place in public estimation, by bringing their established organizations and distributing facilities to the dissemination of child health instructions, and by encouraging the May Day demonstrations throughout the country. It is also to be hoped that public officials generally will assist as they did last year.

As successive May Days come around, every community will want to boast that its children have been born under proper health conditions, that malnutrition is unknown within their city limits, that clinics have been established for prenatal care and the examination of babies and children of preschool age. Although May Day is the special day set aside for a child health audit in every community, the American Child Health Association urges that it be no different than any

*From the Division of Publications American Child Health Association.

other day. Why not celebrate May Day 365 days this year? Why not continue to build that city of healthy, happy boys and girls that you began on May 1?

There are certain items that every community should check up to insure health to its child population. Is the milk being delivered at your home every morning fit for your children to drink? Is it safe and clean? Does the city ordinance demand that it be made safe by pasteurization? Is the water supply pure and adequate? So many times a city-wide disease epidemic has been traced to polluted water. Is your sewerage system adequate and modern? The disposal of excreta is a necessary item in good, sanitary community housekeeping. Are the school buildings, where thousands of your children spend the best hours of every day, well ventilated and properly lighted? Do you boast of parks that are really used as community playgrounds? Are they the recreational centers of your young folks? What is their equipment?

What has your city actually done to build fortifications against smallpox, diphtheria and typhoid fever? Is every child vaccinated against smallpox? What immunization have you provided against diphtheria and typhoid fever?

What steps have you taken to obtain the accurate registration of every baby born within the year? No community health program has been perfected without the complete birth registration.

This is the serious side of May Day. These questions on community health and sanitation should be put before all citizens on May Day. Perhaps the editors of your local newspapers will graciously celebrate the day by giving a column over to popular health education, which may develop into a daily or weekly feature.

Clubs that have pledged themselves to do a definite piece of welfare work might engage a child health specialist to lecture at a free public forum, May 1. We do not need to depend only on the press and lecturers to educate parents in child health. There are the radio, pamphlets dropped on the doorstep, a health lesson for the week posted in the street cars, and a health film projected at the popular motion picture houses.

Carrying out the old ideal of May Day in merrie England, it is to be an annual festival day for the children themselves. In thousands of cities and hamlets in the United States, there will be play festivals or pageants to celebrate National Child Health Day.

In several states, the director of the division of child hygiene of the state board of health will act as a leader to appoint local committees throughout the state to plan their community programs. Louisiana, the state that has been carrying on such an extensive state-wide child health program this year, is encouraging the observance of May Day in every city and parish. Indiana is planning an elaborate program to celebrate the day. The Indiana State Board of Health through its child hygiene division will organize a May Day club and ask all parents to enroll their babies in the club as soon as they are born. It has also been suggested by the state that near every home in Indiana a tree be planted, May 1, in honor of each child born during the year.

There will be as many National Child Health Day programs as there are states in the Union. What participation are you taking in the celebration of May Day as child health day?

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Could not every dentist offer his services to his local board of health and state department of health, in order that the dental profession may share in the National Child Health Day activities? The Department of Dental Health Education will be glad to receive reports of activities.

# CHILDREN'S TEETH—HOW TO USE AND KEEP THEM*

(Compiled by The American Academy of Periodontology, October, 1924)

## PERMANENT TEETH DURING CHILDHOOD

*Why do we have two sets of teeth, a temporary one and a permanent one?*

Teeth do not grow larger as we grow up, so we have a set of twenty small teeth for the little child and a set of thirty-two large teeth for the adult.

*What are permanent teeth?*

They are the second teeth, which come into the mouth from about the fifth or sixth year to about the eighteenth or twenty-fifth year.

*How long should these teeth last?*

All the rest of one's life. It is not normal to lose the permanent teeth.

*What can parents do to help their children have sound permanent teeth?*

Give them, first, a good inheritance of health with which to begin life.

Feed them the right foods in the proper proportions and prevent them from eating unwholesome things, or sweets, which spoil their appetites for more nourishing foods. (See Bulletin No. I "How to Build Sound Teeth" for suggestions as to feeding.[1])

Keep their bodies clean by frequent bathing so that the skin can do its work properly.

See that they have:

Clean, cool water to drink.
Fresh air to breathe.
Sleep, to refresh them.
Regular, daily movement of the bowels.
Happy play.

Teach them to eat slowly and to chew all food thoroughly.

Oversee the brushing of the teeth, and be sure it is well done.

All these things together help develop a healthy chewing, or masticating machine through:

(*a*) Right diet to build sound teeth and their foundations.

(*b*) Exercise to bring the teeth into the right relationship to each other.

(*c*) Cleanliness.

*What should be done in the mouth itself to protect sound teeth and keep them healthy?*

Food should be chewed thoroughly.

Some coarse or crusty food should be eaten each day to give the gums and the tissues that support the teeth the exercise they require to keep them well. Celery, ripe apples and other fresh fruits, bran muffins, coarse grain breads and cracked wheat and other whole cereals are useful for this purpose.

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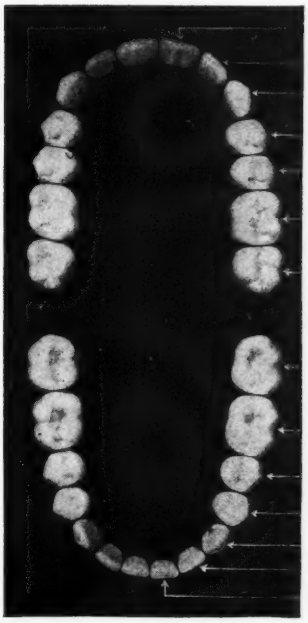
*Bulletin 2, Part 2. This is one of a series of bulletins on the teeth and their care for the information of the public.

1. How to Build Sound Teeth, 11: 443 (May) 1924.

## THE PERMANENT TEETH

(32 in number)




The third molars come in behind the second molars.

## ERUPTION OF PERMANENT TEETH

| Teeth | Approximate age (years) |
|---|---|
| Central incisors | About 7 |
| Lateral incisors | About 8 |
| First bicuspids | About 9 |
| Second bicuspids | About 10 |
| Cuspids | 11 or 12 |
| First molars | 5 to 6 |
| Second molars | 12 |
| Third molars | 18 to 25 |

The teeth and gums should be brushed regularly morning and night every day. (See Part I of Bulletin II[2] for method of brushing the teeth.)

The mouth should be examined by a dentist at least twice each year and any necessary protective work should be done.

*What can the dentist do to help safeguard the teeth against disease?*

1. Give the teeth a thorough cleansing at regular intervals of once in a month or once in two or three months as the case may require.
2. Examine the mouth frequently enough to discover and check any decay of the teeth.
3. Place a protecting layer of cementum in the pits and fissures in the chewing surfaces of the molars to prevent decay.
4. Teach the child how to brush the teeth and encourage it to brush them regularly.
5. Teach both parents and child the importance of a healthy mouth, and the dangers of cavities in the teeth, which lead to the formation of abscesses, resulting in diseases of the body and loss of the teeth.
6. Fill any cavities that develop in the teeth.
7. Recommend that crooked teeth be straightened.

*When do the permanent teeth come into the mouth or erupt?*

The accompanying chart gives this information.

*What happens to the deciduous teeth to make them loosen and drop out?*

The permanent teeth growing underneath the temporary teeth push against their roots and cause them to be absorbed, thus making room for the incoming permanent teeth.

*Are the permanent teeth full grown when they come into the mouth?*

The crowns of the teeth are as large on the outside as they will ever be, but they have not finished growing on the inside, where the pulp (the nerve and blood vessels) is, and the roots keep on growing for three or four years, until they have reached their full length.

*Which permanent teeth erupt first?*

The four first permanent molars, which normally come into the mouth when the child is 5 or 6 years old are the first permanent teeth to erupt.

*Are deciduous or temporary teeth shed to make room for the first permanent molars?*

No. The first permanent molars replace none of the twenty deciduous teeth. In fact, none of the twelve permanent molars replace any of the deciduous teeth.

*How can one know which teeth ar the first permanent molars?*

Each one of the four first permanent molars takes its place immediately behind the deciduous tooth which is the farthest back in the mouth on the right and the left sides of both upper and lower jaws.

Counting back from the median line between the two front teeth, each first permanent molar is the sixth tooth. These teeth are larger than the deciduous molars.

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2. Children's Teeth—How to Use and Keep Them, 11: 450 (May) 1924.

*Why are the first permanent molars so important?*

1. They hold the jaws in a definite relation to each other while the twenty deciduous teeth are being shed and the permanent teeth are taking their places.
2. Their position in the mouth has much to do with the regularity or irregularity of the other permanent teeth.
3. The whole chewing or masticating apparatus is seriously crippled if these teeth are damaged or lost.
4. They are the only grinders while the temporary molars are being exchanged for permanent bicuspids.

*Do the teeth need especial attention and care in brushing during the years when the temporary teeth are being shed and the permanent teeth are erupting?*

Yes. Collections of foodstuffs and bacteria are usually greater at this time because the child is most apt not to exercise and cleanse its teeth by thorough mastication, owing to the fact that some of the teeth are loosening and spaces exist that are not yet filled by the incoming permanent teeth.

*Does masticating the food have a cleansing effect on the teeth?*

Yes, especially so when crusty, dry, coarse or hard foods are chewed.

*Do foods other than the kind just mentioned have a cleansing action on the teeth?*

Almost all fruits, tomatoes, celery and the raw vegetables generally have a cleansing effect on the teeth. That is one of the reasons why fruit is recommended as a dessert.

*Does the mastication of food affect the growth of the child?*

Yes. When food is properly chewed and mixed with saliva, the greatest food value can be extracted from it by the digestive apparatus. It takes a less quantity of food to supply the body when the food is well masticated than when it is not, and the results of digestion are far more satisfactory. When the full value of food is obtained by the process of digestion, the growth and development of the child are aided. Improperly masticated food is only partly digested, and therefore may act as an irritant to the stomach and intestines, sometimes causing vomiting and diarrhea and sometimes constipation. Any of these interfere with the growth of the child.

*Is it best that growing children learn to chew their food on both the right and the left sides of the jaws?*

It is very important, because this exercise develops the bones and the muscles of the head and face. If the child uses only one side of the jaws for masticating food, the development of this side will be greater than that of the other side, and an inharmony of growth will result.

Similarly, if teeth are lost on one side, that side will not develop properly. Hence, the importance of saving teeth.

*Will hard use of the teeth injure them?*

No. It will help them and their supporting structures of bone and overlying gums to keep healthy. It will also help the jaws to grow large enough so that there will be room for all the teeth.

The teeth are the hardest structures of the body, the gums are very tough and insensitive and the muscles of mastication are the most powerful, considering their

size, of all muscles in the body; which shows that they are all intended for hard work.

However, children should not be allowed to crack nuts or bite threads with their teeth. They were not meant for that and should not be abused.

*If a child's teeth are crooked from the time they come through the gums, what can be done to correct their irregularity?*

They can be straightened by an orthodontist, a dentist that devotes his time to the work of making room in children's jaws for the permanent teeth and moving the teeth into their right places.

*Should irregular permanent teeth be straightened?*

Yes. Usually, teeth that are not in their proper positions cannot do their work of biting off, tearing or masticating food very well. In some bad cases of irregularity of the teeth, the child (or adult) cannot really chew its food at all.

Again, irregular teeth are very hard to keep clean and so are apt to decay easily.

They are also unattractive because it is not normal for teeth to be crooked.

Correction of irregularity of the teeth so that the masticating machine can function properly is a great benefit to a child throughout life.

*When should the position of irregular teeth be corrected?*

It is wisest to consult an orthodontist or a dentist as to the age at which it is best to start to straighten an individual child's teeth, because there are several things that have to be considered before starting this piece of work.

In general, the sooner the work of regulating the teeth can be begun, the better.

*Do teeth, especially front ones, that seem crooked while they are erupting, ever correct their positions so that they are even and in their right places?*

Sometimes they do; but it is best to consult the dentist or orthodontist for advice if the teeth are still irregular after they are fully erupted.

*Does the straightening of the teeth cause much annoyance or pain to the child?*

If it is properly done, there is little discomfort.

*How much time is required to correct irregularity of the teeth?*

The time required differs with the kind and degree of irregularity of each case. One, two, three or more years may be needed to create room enough for the teeth and to move them into their correct positions.

*What are some of the causes of irregular teeth?*

1. Bad feeding resulting in undernourishment of the child and consequently in poor development of the jaws.
2. Adenoids and enlarged tonsils, which result in mouth breathing.
3. Thumb, finger or tongue sucking.
4. Lack of hard or coarse foods at meals and failure to exercise the teeth and their supporting tissues by chewing the food thoroughly.
5. Too early loss of the deciduous teeth through decay.
6. Loss of that very important tooth, the first permanent molar. All these causes are preventable.

*Why do the teeth of children decay?*

Chiefly, because the children at some time (either before or after birth) were undernourished, and their teeth were consequently not well built to start with or did not have the right food to keep them strong and resistant to disease.

Wrong diet, too much cake, candy and other soft, sweet food will also cause decay.

Nervous strains and mental irritations frequently disturb the nourishment of the body to such an extent that cavities form in the teeth.

Illness that breaks down the bodily health can be a cause of decay of the teeth.

Fatigue, which results from too long a time at hard play or work without enough rest and sleep, is also a cause of tooth decay.

Lack of vigorous use of the teeth and failure to keep them clean help to cause decay of the teeth.

*If a child's permanent teeth decay should they be filled?*

Yes, immediately, unless they are so far destroyed that it is necessary to extract them. If parents will only take their child to the dentist at least twice every year (oftener if the teeth decay rapidly), cavities can be discovered and filled while they are small, thus saving tooth structure, pain, time and money. There is nothing to recommend delay in having cavities filled.

*Where do cavities usually form on the teeth?*

On the surfaces of the teeth that are protected from the rubbing of the cheeks, lips, tongue and food, from the free washing of saliva and from the cleansing action of the toothbrush. These protected areas are the pits and fissures in the chewing surfaces of the teeth, the sides of the teeth that are next to each other and the necks of the teeth where the margins of the gums overlap the teeth.

*What causes "gum boils" or abscesses to form?*

The pulp, that is the nerve, bloodvessels and the tissue surrounding them, which is found inside each tooth, dies as a result of tooth decay or of an injury. This pulp, in turn, decays or decomposes because bacteria find their way in and gases form, and explode through the opening at the end of the root, carrying bacteria out into the tissues. The bone and soft tissues at the root end of the tooth become infected and are destroyed, and a cyst or an abscess results. The abscess is full of pus, which works its way out through the bone and the gum and forms a gum boil, which breaks and discharges pus.

*What should be done with a tooth that has a cyst or an abscess?*

In most cases, the tooth should be extracted because the teeth whose pulps have died are apt to cause disease in other parts of the body.

*What diseases do they often cause?*

Rheumatism, neuralgia, headaches, eye and ear troubles, heart disease, abscesses of the stomach, kidney, liver, etc.

*Is the roentgen-ray picture a help in determining whether or not a pulpless tooth (one in which the pulp has died) is a possible source of disease?*

It is a great help, but it is not the only means of securing real evidence against a tooth since it cannot show all sides or conditions.

*What is wrong when the gums bleed?*

The gums should not bleed any more than the hand or face should bleed, and they will not when they are healthy. It is a sure sign of inflammation of the gums if they bleed when the teeth are brushed or at any other time, unless they are injured.

*What causes the gums to be inflamed?*

The most usual causes are

1. Incorrect diet, and lack of proper exercise of the teeth and their foundation tissues.
2. Uncleanly mouth conditions which include the collection of calculus (tartar), bacteria, food remnants and other débris on and around the teeth and gums.
3. Decayed teeth.
4. Food packing between the teeth.
5. Improperly constructed fillings or other dental repairs.

*Is this a serious or dangerous condition?*

Yes, 50 per cent of the teeth are lost as a result of disease, often beginning in this way.

*What can be done to correct this condition?*

1. Correct the diet so that the child will have the right foods.
   (*a*) Fruits—apples are especially good.
   (*b*) Fresh vegetables—spinach, carrots, beet greens, celery, lettuce, cabbage, tomatoes, etc.
   (*c*) Milk.
2. Exercise the teeth and gums by proper mastication of hard foods.
   (*a*) Coarse breads and cereals.
   (*b*) Coarse vegetables.
3. Cleanse the mouth thoroughly twice each day and have cleansing treatment by the dentist at regular intervals.
4. Have all cavities filled carefully.
5. Show the child how to brush the teeth. He should be encouraged by parents and dentist to care for them daily.

Most diseases of the teeth and gums can be entirely prevented if intelligent care is begun soon enough and is persisted in throughout life. Correct habits of life are essential to the well being of the child and to the health of its mouth.

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"How to Build Sound Teeth" (Bulletin I) and "Children's Teeth—How to Use and Keep Them" (Bulletin II, parts 1 and 2) may be obtained from the Department of Dental Health Education, American Dental Association, 5 N. Wabash Avenue, Chicago, Illinois, at the following prices:

| | |
|---|---|
| 1— 10 copies, postage prepaid | 5c each |
| 10—100 copies, postage prepaid | 4c each |
| 100 copies, postage prepaid | $ 3.00 |
| 500 copies, expressage collect | 12.50 |
| 1,000 copies, expressage collect | 23.00 |

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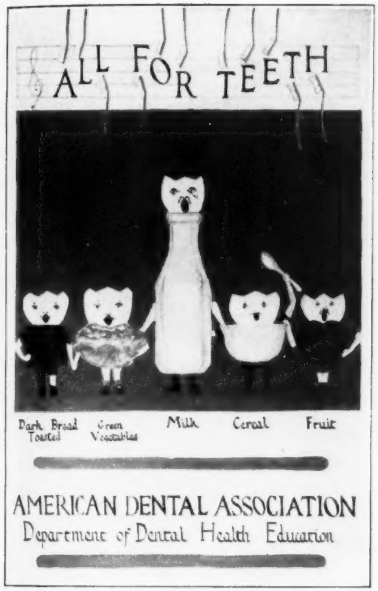
## POSTERS FOR SCHOOLS, CLINICS AND OFFICES

The four posters at the top of pages 479 and 480 were designed for children's use and are printed on paper which may be crayoned or painted by the child. The set of four (18″x24″) may be purchased for $2.00; small posters (6″x8″) are 3 cents each. For further information write the Department of Dental Health Education, American Dental Association, 5 N. Wabash Avenue, Chicago, Illinois.



Posters for Schools, Clinics and Offices

## TRAINING COURSES FOR DENTAL HYGIENISTS IN THIS COUNTRY

Following is a list of the training courses for dental hygienists:

*Columbia University,* Courses in Oral Hygiene, 309 East thirty-fourth Street, New York City. Dr. Frank T. Van Woert, Director of the School of Dental and Oral Surgery. Dr. Anna V. Hughes, in charge of Oral Hygiene Courses.

*Forsyth-Tufts Training School for Dental Hygienists.* Forsyth Dental Infirmary, 140 The Fenway, Boston, Mass. Dr. Harold DeWitt Cross, Director.

*Marquette University,* College of Dentistry, School for Dental Hygienists, 140 Sixteenth Street, Milwaukee, Wisconsin. Dr. Henry L. Banzhaf, Dean of the College of Dentistry.

*Northwestern University Dental School,* School for Dental Hygienists, 31 West Lake Street, Chicago, Ill. Dr. Arthur D. Black, Dean of the Dental School. Dr. Frank B. Rhobotham, Director of Hygienists' Course.

*Rochester Dental Dispensary,* School for Dental Hygienists, Rochester, New York. Dr. Harvey J. Burkhart, Director.

*Temple University,* School for Oral Hygienists, School of Dentistry, Eighteenth and Buttonwood Streets, Philadelphia, Pa. Dr. I. Norman Broonel, Dean. Dr. Helen M. Beck, Director, School for Oral Hygienists.

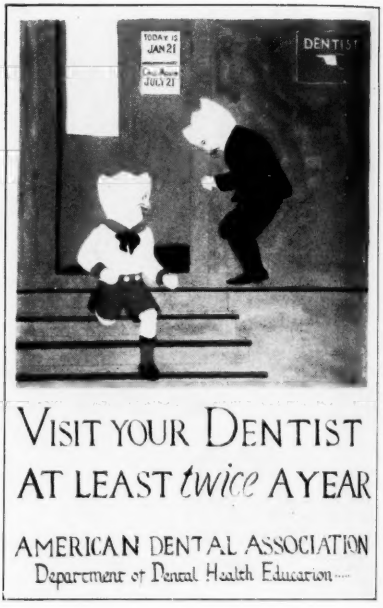
*The Thomas W. Evans Museum and Dental Institute,* School of Dentistry, University of Pennsylvania, Fortieth and Spruce Streets, Philadelphia, Pa. Dr. Charles R. Turner, Dean of the School of Dentistry. Dr. James E. Aignier, Acting Director, Courses in Oral Hygiene.

*University of California,* College of Dentistry, Training School for Dental Hygienists, Parnassus and First Avenues, San Francisco, Calif. Dr. Guy S. Millberry, Dean of the College of Dentistry.

*University of Michigan,* College of Dental Surgery, Ann Arbor, Mich. Dr. Marcus L. Ward, Dean of the College of Dental Surgery. Dr. Hertha Hartwig, Instructor in Hygiene.

*University of Minnesota,* School for Dental Nurses (Hygienists), 305 Dentistry Building, University of Minnesota, Minneapolis, Minn. Dr. Alfred Owre, Dean of the College of Dentistry. Dr. Harold J. Leonard, Superintendent, School for Dental Nurses.

Be Choosey And Chewsy
"I CHOOSE MY FOOD WISELY
SHE CHEWS HER FOOD WELL"
AMERICAN DENTAL ASSOCIATION
Department of Dental Health Education




Posters for Schools, Clinics and Offices

## INDUSTRIAL DENTAL DISPENSARIES

A reprint of the article "The Obligation of the Profession to the Factory Worker," by Dr. Pettibone, which appeared in the February issue of *The Journal*, was sent to the dental directors of the dispensaries listed, together with a letter soliciting aid in bringing the list up to date. For the information of those who are interested in revising the original list, the following additional information is given: Clinics discontinued: Walworth Mfg. Co., Boston, Mass.; Pierce Arrow Motor Car Co., Buffalo, N. Y.; Virginia Lead Mine Co., Austinville, Va.; Union Electric Light and Power Co., St. Louis, Mo.; and the General Electric Co., St. Louis, Mo.

Dr. Frank B. Hart is the dental director of the Virginia-Alberine Co., Schuyler, Va.

The Whitlock Tobacco Co., Richmond, Va., has as director Dr. A. G. Leach.

The clinic of the Jordan-Marsh Co., Boston, Mass., has the following staff: Dr. H. L. Peacock, director; Dr. J. W. Nevins, and Miss Madeline Godfrey, Dental Hygienist.

The Cheney Bros. Mfg. Co., South Manchester, Conn., has a prophylactic clinic. Mrs. Mary Clarke and Miss Ann A. Lester are the dental hygienists.

## FIELD NOTES*

The Jefferson County Dental Society of Kentucky has voted to conduct a poster contest in its county. The posters will be displayed at the annual meeting of the American Dental Association in Louisville, Sept. 21-25, when prizes for the best posters will be given.

The Oral Hygiene Committee of the New York State Dental Society is cooperating with the state division of Maternity, Infancy and Child Hygiene in providing dentists to lecture before medical societies on the care of teeth of preschool children and of expectant mothers.

The third annual dental clinic for children of lower Manhattan, conducted by the Bowling Green Neighborhood Association with the aid of the Columbia School of Oral Hygiene and the Association for Improving the Condition of the Poor is now open. Fifteen operators will examine the teeth of about 1,500 children, making a careful record of the needs of each. At the end of the school year prizes will be awarded to children who have taken the best care of their teeth since last year's clinic.

*The Department of Dental Health Education will be glad to receive items of news along the lines of education in dental or general health.

# BOOK SHELF SERVICE

The Department of Dental Health Education takes pleasure in announcing the Book Shelf Service.

Knowing that many dentists are anxious to add books on the various phases of public health to their libraries, the Department has developed the following bibliography and service.

The bibliography is brief, but contains late and important books on the subjects. The division of topics was made with the general training and interest of the dentist in mind; while the group of books in each division has been endorsed by a specialist in that particular field. From time to time, new books will be announced in THE JOURNAL and added to the book shelf. A copy of the bibliography will be mailed on request to the Department.

In order that those who are interested in purchasing any of the listed books may have a chance to peruse them previous to purchasing, a package of not more than five books will be forwarded and may be retained for a week, provided expressage is paid by the recipient both ways. In the case of the National Health Series and the Child Health Library, either complete set will be sent. No books are sold by the Association. Those wishing to avail themselves of this service should address the Department of Dental Health Education, American Dental Association, 5 N. Wabash Ave., Chicago, Ili.

## BIBLIOGRAPHY

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| TITLE | AUTHOR | PUBLISHER |
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| A Layman's Book of Medicine | Cabot | Houghton, Mifflin Company. |
| *Community Health | Armstrong | Funk & Wagnalls Company, (The National Health Series) |
| *Exercises for Health | Means | Funk & Wagnalls Company, (The National Health Series) |
| Health | Hoffman & Covington | H. F. Hoffman, 324 Metropolitan Building, Denver, Colorado. |
| Health Building and Life Extension | Fisk | The MacMillan Company |
| *Health for the Worker | Frankel | Funk & Wagnalls Company, (The National Health Series) |
| Heredity and Environment | Conklin | Princeton University Press. |
| Home and Community Hygiene | Broadhurst | J. P. Lippincott Company |
| How to Live | Fisher & Fisk | Funk & Wagnalls Company. |
| *Human Machine | Howell | Funk & Wagnalls Company, (The National Health Series) |
| Listen In: Radio Talks | Greene | American Red Cross. |
| *Man and the Microbe | Winslow | Funk & Wagnalls Company, (The National Health Series) |
| *Personal Hygiene | McLaughlin | Funk & Wagnalls Company, (The National Health Series) |
| Personal Hygiene Applied | Williams | W. B. Saunders Company. |
| *Taking Care of Your Heart | Hart | Funk & Wagnalls Company, (The National Health Series) |
| The New Public Health | Hill | The MacMillan Company. |
| *The Quest for Health | Tobey | Funk & Wagnalls Company, (The National Health Series) |
| The Science of Living | Sadler | A. C. McClurg & Company. |
| What Men Live By | Cabot | Survey Associates, 112 E. 19th Street, New York City. |

### MATERNAL, INFANT & CHILD HYGIENE

| | | |
|---|---|---|
| Food Health and Growth | Holt | The MacMillan Company. |
| Nutrition of Mother and Child | Moore | J. B. Lippincott Company. |
| *The Baby's Health | Bolt | Funk & Wagnalls Company, (The National Health Series) |
| *The Child in School: Care of its Health | Wood | Funk & Wagnalls Company, (The National Health Series) |

| TITLE | AUTHOR | PUBLISHER |
|---|---|---|
| The Child; His Nature and His Needs | | The Children's Foundation, Valparaiso, Indiana. |
| *The Expectant Mother: Care of Her Health | DeNormandie | Funk & Wagnalls Company, (The National Health Series) |
| The Mother and Her Child | Sadler | A. C. McClurg & Company. |
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| The Psychology of Insanity | Hart | The MacMillan Company. |
| *Your Mind and You; Mental Health | Pratt | Funk & Wagnalls Company, (The National Health Series) |
| **MOUTH HYGIENE** | | |
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| Care of the Teeth (1915) | Brackett | Harvard University Press. |
| Everyday Mouth Hygiene (1920) | Head | W. B. Saunders Company. |
| Hygiene: Dental and General (1920) | Turner | C. V. Mosby Company. |
| Modern Dentistry for the Laity (1922) | Crocker | The Dental Register, Cincinnati, Ohio. |
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| Popular Essays on the Care of the Teeth and Mouth (1908) | Bell | Parker P. Simmons. |
| Prevention of Dental Caries and Oral Sepsis (1914) | Pickerill | Paul S. Hoeber. |
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| Teeth and Health (1921) | Ryan & Bowers | C. P. Putnam's Sons. |
| The Care of the Teeth (1902) | Hopkins | D. Appleton & Company. |
| Your Teeth (1923) | Towne | R. S. Towne, Bismarck, North Dakota. |
| **MOUTH HYGIENE BOOKS FOR CHILDREN** | | |
| Aunt Jane's Tea Set | Proctor | Jones Book Store, 426 West Sixth Street, Los Angeles, California. |
| Billy Forget-me-not and Buddy | Tanner | De Sanno and Hoskins. |
| Child's Book of the Teeth | Ferguson | World Book Company. |
| The De Kay Brownies | Proctor | Jones Book Store, 426 West Sixth Street, Los Angeles, California. |
| The Toothbrush Man's Own Book | Cavanor | Arrow Publishing Company. |
| Your Teeth | Towne | R. S. Towne, Bismarck, North Dakota. |
| **FOODS AND NUTRITION** | | |
| American Home Diet | McCollum & Simmonds | Frederick C. Mathews Company. |
| Chemistry of Food and Nutrition | Sherman | The MacMillan Company. |
| Diet for Children | Peters | Dodd, Mead and Company. |
| Feeding the Family (Revised) | Rose | The MacMillan Company. |
| *Food for Health's Sake; What to Eat | Gillett | Funk & Wagnalls Company, (The National Health Series) |
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|---|---|---|
| Nutrition—Chemistry of Life | Mendel | Yale University Press. |
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## HEALTH MAGAZINES FOR THE WAITING ROOM TABLE

Hygeia—Published monthly by the American Medical Association, 535 North Dearborn Street, Chicago, Illinois, $3.00 a year.

Nation's Health—Published monthly by the Modern Hospital Co., 22 East Ontario Street, Chicago, Illinois, $3.00 a year.

American Journal of Public Health—Published monthly by the American Public Health Association, 370 Seventh Avenue, New York City, $5.00 a year.

Survey, The—Published twice a month by the Survey Associates, 112 East 19th Street, New York City, $5.00 a year.

## NATIONAL HEALTH SERIES

A series of twenty books on all phases of human health which have been written for the National Health Council by leading authorities in the country. Published by Funk & Wagnalls Company. These books are intended for the general lay public and sell at 30c each or $6.00 for the set of twenty. In the bibliography books marked with an asterisk belong to the series. A complete list of titles and authors is as follows:

| TITLE | AUTHORS |
|---|---|
| Adolescence | Maurice A. Bigelow, Ph.D. |
| Cancer | Francis C. Wood, M.D. |
| Community Health | Donald B. Armstrong, M.D., Sc.D. |
| Exercises for Health | Lena L. Meanes, M.D. |
| Food for Health's Sake | Lucy H. Gillett, M.A. |
| Health for the Worker | Lee K. Frankel, Ph.D. |
| Home Care of the Sick | Clara D. Noyes, R.N. |
| Love and Marriage | T. W. Galloway, Ph.D., Litt.D. |
| Man and the Microbe | C. E. A. Winslow, Dr. P.H. |
| Personal Hygiene | Allen J. McLaughlin, M.D. |
| Taking Care of Your Heart | T. Stuart Hart, M.D. |
| The Baby's Health | Richard A. Bolt, M.D. |
| The Child in School | Thomas D. Wood, M.D. |
| The Expectant Mother | R. L. DeNormandie, M.D. |
| The Human Machine | W. H. Howell, Ph.D., M.D., L.L.D., Sc.D. |
| The Quest for Health | James A. Tobey, M.S. |
| The Young Child's Health | Henry L. K. Shaw, M.D. |
| Tuberculosis | Linsley R. Williams, M.D. |
| Venereal Diseases | W. S. Snow, M.D. |
| Your Mind and You | George K. Pratt, M.D. |

## CHILD HEALTH LIBRARY

The Child Health Library is a series of ten books by practicing specialists of the highest standing, giving information on every phase of child health published by Robert K. Haas, Inc., 218 West 40th Street, New York City, price $3.00 a set. A complete list of titles and authors is as follows:

| TITLE | AUTHORS |
|---|---|
| Babies—Their Feeding and Care | Louis C. Schroeder, M.D. |
| Communicable Diseases of Childhood | Stafford McLean, M.D. |
| Dangers of the School Age | M. Alice Asserson, M.D. |
| Educational Problems | David Mitchell, Ph.D. |
| How Children Ought to Grow | John C. Gebhart |
| Hygiene of the Mouth and Teeth | Thaddeus P. Hyatt, D.D.S. |
| Prenatal Care and the Child's Birth | Harbeck Halstead, M.D. |
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| What Children of Various Ages Should Eat | Lucy H. Gillette, M.A. |

The Journal of the American Dental Association
5 North Wabash Avenue, Chicago, Illinois.
Please send in promptly notice of change of address, giving both old and new. Important information regarding subscription price, etc., will be found in the advertising pages.

# *Editorial*

## FORTY THOUSAND MEMBERS IN 1925

There is no reason why this mark cannot be reached by a little exertion on the part of our constituent societies. There is real force in numbers—an impetus that, aside from all material gain, lends momentum, stability and inspiration to an organization. Every local, district or state society that is a component of the American Dental Association should feel the inherent obligation that it owes to the parent body to increase its membership in all legitimate ways, and every member of these organizations should pledge himself to seek out the quiet, worthy practitioners in his vicinity who are not in the society, and extend to them the right hand of fellowship and welcome.

There is a glow of satisfaction in every man's consciousness when he has been instrumental in getting new members into an organization like this. All over the land there are men who today are holding their heads a trifle higher and taking more pride and satisfaction in their profession because of the fact that they hold membership in the largest and most representative dental organization in the world; and there is no reason why a privilege of this kind should not be extended to all the worthy men and women who minister to the dental needs of the American people, no matter in what remote place they may practice. Let us show to these outsiders the advantage, not only to our organization but particularly to them, of the largest possible representation in this our great national body, where the humblest in our ranks may take his place side by side and on an equal footing with the most progressive and scientific men in the profession.

Our organization is democratic in the highest degree, and every worthy practitioner is welcome to full membership. It becomes a very urgent duty for every one who accepts membership to use at once his influence with those on the outside. This is particularly true as it relates to the recent graduates, who are entering the profession every year. There are several thousand of them, and they constitute what

must ultimately become the bone and sinew of organized dentistry. They should be brought into our ranks as early as possible in their professional careers, and should be made to feel at once that they are an integral part of this great cohesive organization.

In every community where colleges are located and where young men and women are being turned out each year to augment the number of dentists, the members of the American Dental Association in those communities should seek out the available candidates for membership and invite them into the organization. It should be not only a pleasure but also a duty to do this. In the next few months, there should be added to our membership enough new names to bring it well over the 40,000 mark. The state societies are holding their meetings in every section of the country, and it should be the ambition of the officers to swell the number of their members till they embrace all the available practitioners in the state. There is no good reason why every ethical dentist in America should not belong to this great national organization. In some sections, we find nearly one hundred per cent of the ethical practitioners in our ranks, and if this is true of one section, it may just as easily be true of others. It is only a matter of enthusiasm and application on the part of those in the Association. The great difficulty is that, when a man gets in the organization, he frequently pats himself complacently on the back and sits calmly down to the enjoyment of his privileges—apparently forgetful of the fact that there are others of his fellow practitioners outside the ranks who are as much entitled to membership as he. Many times, it is the quiet, diffident, unobtrusive man who remains outside organized dentistry, when, as a matter of fact many of these quiet men have a possibility for good that needs only encouragement and development to be of immense benefit to the dental society and to the profession at large. Let us search out the quiet men and get them in. They are usually the thinkers, and we need thinkers in our organization.

Forty thousand members banded together in an enthusiastic endeavor to elevate dentistry could put it on a plane never dreamed of by the men of even a decade ago. Shall we not reach this splendid goal?

C. N. Johnson.

## MONEY AND RESEARCH

Need of money is always a concluding argument when inactivity in research is under discussion. However else the colloquium begins, this ends it. It may be mentioned early in the conference, too, to bring the terminus close to the beginning. The facts that intervene are too dis-

quieting for enjoyable conversation. No money places the responsibility without the walls, at least as far without as the board of trustees. This saves the embarrassment of admitting the light that the Socratic method would throw upon the real status of our research program. Now we have money.

March 3, 1925.

"Receipt is acknowledged of your letter of February 28 making inquiry as to whether or not dentistry will be included in the research program of the John Simon Guggenheim Memorial Foundation.

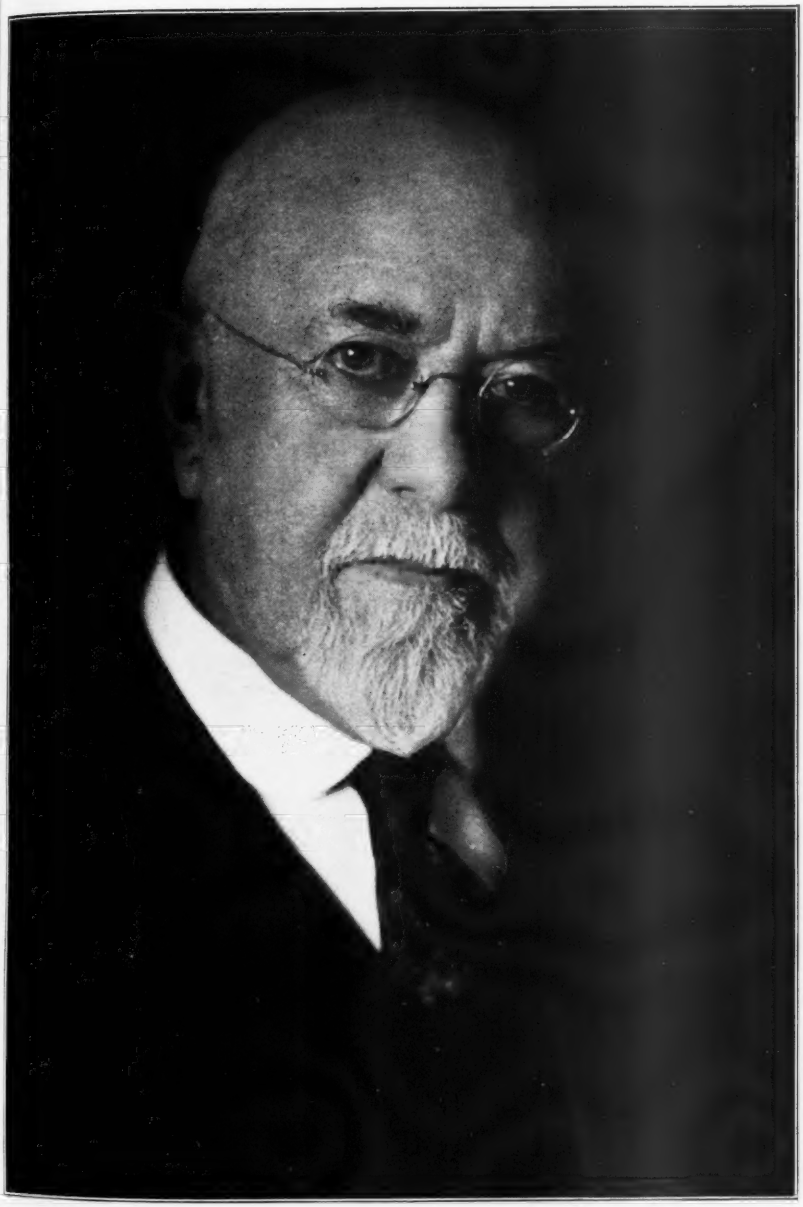
"If some member of the dental profession has projects for research which he wishes to carry out, the way is open for him to apply for a fellowship on the John Simon Guggenheim Memorial Foundation, understanding, of course, that the awards in any given year will be given only to applicants of outstanding ability."

This is a challenge to the hypothesis that money is the vital need. It invites for proof the assurance that we can meet our own issues in our own laboratories.

THE JOURNAL has spoken clearly on what it believes to be the need of dentistry in this department of its activities. It has commented freely on what it believes the crux of our investigative need. It has called attention to the character of most of our published material and awaits the proof that it is in error. Who of our workers today can present a problem commensurate with the needs of dentistry combined with credentials for its solution and needs money? Money is available.

It is far from our thought to note weaknesses or needs or inabilities from any cause except to aid the system of which we are a part. As an organization, thought of collectively or as college units, we have given much reflection to the problems of teaching and administration but scant attention has fallen upon this tremendous responsibility without which progress and scholarship would rapidly asphyxiate in their own waste products.

Research, investigation, creative scholarship is the child of our educational concept. It must be nurtured, and induced to grow. It must be made to feel that it is essential to complete the function of the dental school. It cannot be left to the laboratories of houses of trade. Educational institutions must be able to stand guard over the elements that go into the body of dental learning. One is led to believe that if this branch had been shown a welcome by our colleges, scholarship would not only have attained a higher educational level but we should be saved some of the schisms separating men and institutions into groups over issues that scholarship and the knowledge that is born of investigation would have made impossible.



GEORGE ANDREW BATES, M.S., D.M.D.
1847-1925

# IN MEMORIAM

## George Andrew Bates, M.S., D.M.D.
## 1847-1925

By Henry H. Piper, D.M.D., Boston, Massachusetts

The death of Dr. Bates will be deeply and widely felt. He will be missed, first as a teacher, and perhaps even more as a man, varied in his interests, friendly and serviceable in his personal relations.

Dr. Bates was born in Boston, in 1847, but in infancy moved to Weymouth, Mass., and later lived for brief periods in the State of New York, Boston, Lowell, and Salem, Mass., where after finishing the grammar course, he left school to help in the support of the family. He went to work and remained at work, gaining steadily in competency, and finding ever more important positions till he achieved the management of a printing establishment, his age being now nearly 40 years.

For a long time, he had nursed the hope that one day he might enter a profession. He determined to take up dentistry, and while continuing his business, he obtained training in the office of a dentist which fitted him to enter the Boston Dental College as a second year student. He graduated in the class of 1889.

The ideals of Dr. Bates were always high, despite the comparatively low standards of dentistry of forty years ago. Graduating from the dental school proved not to be a goal. Out of his study there, as he listened to Dr. Robert R. Andrews and saw his pictures flashed on the screen, he determined to enter research work. Histology made an instant appeal, and so well did he employ himself in this new interest that he was called to teach histology in the Boston Dental College, in 1891. He had found his vocation. Office practice became more and more irksome to him, but he continued to minister to patients for a considerable period.

The merging of the Boston Dental College in the Tufts College Dental School was a red letter day in Dr. Bates' calendar, for it meant a larger scope; it was a demand, also, that he meet certain academic conditions he had not fully realized till then, scarcely could have realized earlier, involving lines of study leading to the degree of M.S. When he had finished this course in graduate study, carried on partly at Tufts College under Prof. Kingsley, and partly at the research laboratory at South Harpswell, Maine, he was long past 50 years of age; but the question of age seemed never to weigh upon him. During the next twenty years and more, his associates in the dental and medical schools saw him prosecute his work with a joy that meant congenial tasks and with an ever gaining efficiency.

Honors came to him, in his own school and city, and in a larger field, as his voice was heard more widely and the knowledge of him extended; and he lived to feel, as he must have felt, that he was held to be a thoroughly equipped and competent worker in his chosen domain. And what a cumulative life it was professionally, how vital to the very end, with not the loss of a single day.

His studies and research led him directly into the wonderland of histology and biology, but he did not stop there. He was led to muse over the greater marvel of life in its full significance, the beauty, the complexity, the mystery of it all. And fortunate is any man who, like him, finds it a satisfaction to enter this illimitable field and, leaving for a time the senses and the material world on which the senses dwell, leaving demonstrable facts and the exact truths of mathematics, feel the uplift of emotional realities wrought into high ideals; of love, loyalty, sympathy, fellowship, goodness, reverence, worship.

# Medical and Dental News

## CALIFORNIA

Dr. R. H. Volland, instructor in operative dentistry, Northwestern University Dental School, gave a series of three lectures in San Francisco at the College of Dentistry, University of California, January 5, 6 and 7, 1925, under the auspices of the California State Dental Association and the Alumni Associations of the University and the College of Physicians and Surgeons. Dr. Volland discussed various phases of the use of the gold inlay with special reference to occlusion.

Dr. Hermann Prinz, professor of materia medica and therapeutics, University of Pennsylvania, delivered the second annual series of lectures under the University of California Lecture Foundation on "Preventive Dentistry" in San Francisco, Berkeley and Los Angeles during the week of January 5 to 10, 1925. Dr. Prinz's recent extended visit to Europe has given him an international point of view on his subjects which included "Etiology and Treatment of Pyorrhea" and "More Common Diseases of the Tongue".

## FLORIDA

**Volusia County Dental Study Club:** The dentists of Volusia County have organized a study club, with the following officers: President, E. L. Thompson, Daytona; vice-president, H. G. Bow, DeLand; secretary, George Boone, Daytona. The fourteen members meet twice a month.

## ILLINOIS

**All-Community Health Pageant:** The health pageant was held, March 13-14, at the Midway Masonic Temple, Chicago, under the auspices of the Englewood branch of the Chicago Dental Society, the Second District Illinois Federation of Woman's Clubs and the Jackson Park Branch of the Chicago Medical Society, with the Chicago Retail Druggists' Association, the Chicago Department of Health and the Illinois Department of Health cooperating. Tableaus by health groups, lectures, health examinations and contests made up the program. Dr. C. N. Johnson spoke on "The Ethical and Economic Value of Oral Hygiene." Drs. James Ford and Harris W. McClain gave a demonstration showing the relation between irregularity and the growth of the jaw and the health of the child. Dental service was rendered by members of the Englewood Branch of the Chicago Dental Society.

## IOWA

**Medical Centers:** Since its beginning thirty years ago at Johns Hopkins University, the idea of the medical center has been widely developed in this country. Such a center is being built at the University of Iowa with the aid of the Rockefeller Foundation, at a cost of $10,000,000. In Rochester $11,000,000 has been subscribed for a similar project; Yale, Harvard, and the Universities of Michigan, Minnesota, and Colorado, to name only a few examples in this country, have their centers. Among the most recent, and probably most extensive in its projected outline, is the center proposed for New York City, inaugurated by the combination of the School of Medicine of Columbia University and Presbyterian Hospital. Both institutions have outgrown their present quarters and they have decided to build a towering skyscraper to house them both at a cost of $10,000,000 on a twenty-acre plot donated for this purpose, in uptown New York, overlooking the Hudson River. About this key unit other specialized institutions will be developed in time, establishing New York as one of the great medical centers of the world. At the heart of the complex organization and building plan is one simple idea; formulated by the committee in charge:

The best plant for the patient is the

best plant for medical education and research;

The best plant for medical education and research is the best plant for the patient.—The Survey.

## KENTUCKY

**Kentucky Dental Clinics:** Dental clinics have been held in the First District School, Maysville, and in the Lewisburg and Mayslick Consolidated schools, recently, in an effort to stimulate interest in the care of the teeth.

## LOUISIANA

**Louisiana State Dental Society:** The forty-fifth annual meeting of the Louisiana State Dental Society was held in New Orleans, March 6-7, at the Roosevelt Hotel. The following program was given: "Building to Normal Occlusion," by H. G. Morton, Milwaukee, Wis.; "Something New in Full Denture Impressions," by E. F. Watson, Beaumont, Texas, assisted by Dr. B. J. LaCour, Welsh, La.; "Unit of Removable Bridgework," by Drs. Ducasse, Meynier and Ducasse, New Orleans; "Simple Partial Dentures," by Drs. W. J. Healey and C. S. Tuller, New Orleans. At the closing meeting of the forty-fourth annual session of the Louisiana State Dental Society, the following were elected as officers for the ensuing year: President, Harry J. Siess, of Mansura; first vice-president, F. J. Wolfe, of New Orleans; second vice-president, L. J. Schoney, of Donaldsonville; treasurer, O. J. Ory, of Garyville (reelected).

## MARYLAND

**Fraternity Purchases Home:** The Psi Omega Fraternity, University of Maryland chapter, has recently purchased a house at 1111 St. Paul Street, Baltimore.

## MASSACHUSETTS

**Tribute to Dr. Ainsworth:** A golden anniversary testimonial dinner was given to Dr. George Cook Ainsworth, D.D.S., D.M.D., at the Hotel Somerset, Boston, February 26, by about 200 dentists from Boston and the vicinity. Dr. Ainsworth was graduated from the old Boston Dental College, now Tufts College, in 1875, and has been in continual service in the dental profession since that time, as a practitioner and teacher. Dr. Ainsworth has done much not only to advance dentistry but also to bring about a closer cooperation between the medical and dental professions. At the testimonial, he was presented with a gold watch and chain, and a bound volume of hundreds of letters received from professional men in all parts of the country.

**Charles A. Brackett Professorship of Oral Pathology:** Dr. Charles A. Brackett, who is now completing his fiftieth year of active service in the dental school of Harvard University, will retire at the close of the present academic year, when he will receive the title of Professor of oral pathology, emeritus. Dr. Brackett is trustee of and consulting dental surgeon to the Newport City Hospital, president of the Newport Public Library, director and vice-president of the Aquidneck National Bank and director of the Newport Trust Company. A movement is under way to raise a sum of $100,000 to endow the department in which Dr. Brackett has worked, and to create the Charles A. Brackett Professorship of Oral Pathology.

## MISSOURI

**St. Louis County Clinic:** The traveling dental clinic has given free treatment to 636 school children since its establishment last October. The equipment was purchased by the county court, and the clinic is financed by the county health committee of the Tuberculosis Society of St. Louis. It is the outcome of the discovery that 7,000 of 10,000 children examined were in need of immediate care. Forty-eight schools have been visited, and 768 treatments have been given. The St. Louis County Dental Society cooperates by giving its services in inspecting all school children. Teachers report that many of the parents are profiting by the lessons in good health and dental hygiene taken home by the children.

## NEW YORK

**Public Health Meeting:** A public health meeting will be held, April 7, under the auspices of the First District Dental Society of the State of New York. Dr. O'Shea, superintendent of the schools of New York City, will preside, and Mr. Willis Sutton, superintendent of the schools of Atlanta, Ga., will give the principal address. Other speakers will be the mayor, the governor and Senator Royal S. Copeland.

**Dental Hygiene Lecturers:** The Oral Hygiene Committee of the New York State Dental Society offers cooperation with the Division of Maternity, Infancy and Child Hygiene in providing dentists to lecture before medical societies on the care of the teeth of the preschool child and the expectant mother. Requests for this service may be sent to the Division

of Maternity, Infancy and Child Hygiene, or to Dr. Lincoln A. Timerman, 39 Market Street, Amsterdam, N. Y., chairman of the above-mentioned committee.

**Dinner to Dr. Peeso.**—A testimonial dinner will be tendered to Dr. Fred A. Peeso, by his friends in the dental profession, at the Hotel Biltmore, New York City, Saturday evening, May 9, 1925.

## OHIO

**Blanchester Credit Bureau:** Doctors and dentists in Blanchester have formed a credit bureau that will list all people in this vicinity who do not meet their bills for professional service within a satisfactory time limit. Lists will be furnished the members of both professions each month. The system has proved a success in other communities.

**Central Ohio Dental Society Quarterly Meeting:** At the quarterly meeting of the Central Ohio Dental Society, February 4, at Marion, Dr. William DeKleine, head of the child health demonstration, and Dr. I. Lester Furnas, Cleveland, were the principal speakers.

## WASHINGTON

**New Medical and Dental Building:** The new eighteen story Medical and Dental Building recently completed in Seattle and built at a cost of $2,500,000, is unique in that it is under the control of the two professions, and a committee of the occupants will determine who the future lessors of space in the building shall be, it being the intention to keep out "medical fakirs and parasites." This committee, composed of six physicians and six dentists, will investigate all complaints against the ethics of the occupants. The building affords a large assembly room, committee rooms, lockers, kitchen, library and surgeries for minor operations, and a basement garage. It is claimed that most of the occupants are paying 20 per cent less rent for these greatly improved accommodations.

## FOREIGN

**"Gold Cure":** During the past month, newspapers have devoted much space to recent experiments performed by Prof. Molgaard of Denmark in attempting to treat tuberculosis with a chemical substance containing a certain amount of gold. The idea of gold as a therapeutic agent has always had a peculiar fascination for both the public and the physician, so that "gold cures" have been available for practically every type of ill from which mankind may suffer. Unfortunately, none of these "cures" has thus far stood the test of scientific observation. The method devised by Prof. Molgaard has been tested on animals in his laboratories to a rather limited extent. His work has been conducted in a scientific manner, but it is impossible to state from the evidence thus far available whether or not it will have any real virtue in the treatment of tuberculosis. Fortunately, Prof. Molgaard is a thorough scientist, and not inclined to commercialize or to propagate unduly an incomplete investigation. His method has been turned over for further study to other laboratories than his own, including that of the Medical Research Council of Great Britain. Until such independent investigations have been completed, the chemical will not be available for general use.—Time, Dec. 22, 1924.

## DEATHS

**Baldwin, J. Otho,** Springfield, Ill.; Northwestern University Dental School, 1901; died, February 10, 1925; aged 57.

**Brothers, J. P.,** Birmingham, Ala.; Vanderbilt University, Department of Dentistry, 1908; died, February 10, after an operation; aged 42.

**Glantz, Henry W.,** Chicago. Ill; Chicago College of Dental Surgery, 1895; died, Dec. 25, 1924, of angina pectoris; aged 59.

**Heiskell, William L.,** Indianapolis, Ind.; a veteran of the Civil War, and a practicing dentist in Indianapolis for nearly forty-five years; died, March 6, aged 79, after a brief illness. Dr. Heiskell gave up the active practice of dentistry in 1910. He was at one time president of the Indiana State Dental Society.

**Hindle, Frank L.,** New Brunswick, N. J.; Pennsylvania College of Dental Surgery, 1907; died recently.

**McKinney, George B.,** Barry, Ill.; Northwestern University Dental School, 1897; died, Nov. 3, 1924; aged 52.

# CURRENT LITERATURE

## EXTRACTS AND ABSTRACTS

**Lingual Abscess:** These abscesses, while not common enough to be emphasized in the literature, appear often enough that they should be looked for, according to R. A. Barlow (Boston M. & S. J. Feb. 19, 1925). Bennett collected 145 cases, covering a period of ninety years, with three deaths, due to suffocation, hemorrhage and pneumonia following aspiration of pus, one case each. A consideration of the anatomy of the tongue indicates how infection may develop and its probable course. The great amount of swelling in acute inflammation of the tongue is accounted for by the areolar structure of the tongue within its capsule; and excruciating pain results from tension on the surrounding tissues. While the dense capsule of the tongue protects it from invasion by bacteria, and its rich blood supply facilitates its resistance to infection when invaded, the loosely arranged areolar tissue in the base is conducive to abscess formation when infection gains the upper hand. The lingual abscess is usually due to tonsillitis, pyorrhea, caries or trauma. Bacteria may be introduced through the use of the toothpick or through chewing wisps of hay or grass. In its early stages, it is usually thought to be sore throat. Abscesses sometimes form after tonsillectomy. In addition to the symptoms of soreness, swelling and great pain, there are fever and malaise, swelling of the submental glands and pain in the ears. In some cases, the diagnosis is further determined by the presence of a definite area of localized induration. The condition must be differentiated from anthrax, actinomycosis, leprosy, gumma and salivary calculus. Treatment in the early stages is by lavage with hot physiologic sodium chlorid solution. If the abscess does not rupture in a reasonable time, an incision must be made. Recovery occurs within forty-eight hours. The author reports a typical case.

**Winter Sunlight and the Diet:** How diet may supplement winter sunlight is told by H. J. Gerstenberger (Child Health Magazine, January, 1925). From October to April, nutrition suffers because of a decrease in sunlight, and cases of rickets develop. Babies will not thrive on milk alone unless they get a sufficient amount of sunlight. Therefore, in winter, cod liver oil should be added to the diet. In summer, cases of rickets rarely develop. In winter, not only the decrease in sunlight but also the wearing of heavier clothing militates against sunlight reaching the body in sufficient amounts. Colored, Italian and Syrian infants suffer in our climate because the large amount of pigment in their skin limits absorption of the sun's rays. Window glass filters out these rays, and therefore the baby has more chance for absorption of them when placed on the sun porch. Scurvy, a form of malnutrition, is a possible indirect result of lowering of nutrition. This condition may be overcome by the addition of orange or tomato juice to the diet. Water soluble vitamin C is also present in lemons, strawberries and cabbages. The canned tomato furnishes also the water soluble vitamin B, which is active against neuritis. Scurvy and rickets predispose the patient to other diseases, especially of the respiratory system. The diseases of summer have been reduced, and it is suggested that by careful modification of the diet, the diseases peculiar to the winter season may also be reduced

**Teaching of Mouth Hygiene:** The teaching of mouth hygiene to children may be divided into three phases, according to Mildred Gilsdorf (Dent. Summary, January, 1925): (1) that for the child of preschool age; (2) that for the child 6 to 9, and (3) that for the child 9 to 12. The first must come, for the most part, from the parents, who, if it is necessary must be taught. In teaching them, prenatal care can well be emphasized. When dealing directly with the child, stories illustrated by drawings or figures of modeling clay may be used effectively. The young child learns best to use the brush

correctly by imitating the parent. In dealing with the child from 6 to 9 years old, the fact that it is easy to talk over his head should be kept in mind. The child of this age is sensitive and any reference to his helplessness is quickly detected and resented. He likes short stories with a climax. He learns facts about his mouth best through association (number of permanent teeth=number of fingers + number of toes + 1 dozen; the first permanent molar is the corner stone of the mouth; dishes, and so teeth, must be washed three times a day). Posters and rhymes are popular. Modeling clay can be used in various ways. The child 9 to 12 is allowed to do the work himself. He makes the posters, and writes themes and stories on the care of the mouth and the results of neglect. The toothbrush drill comes into its own and the teaching becomes more detailed and constructive.

**Erosion of Teeth:** A case of unilateral hyperhidrosis and erosion of teeth following parotid abscess is reported by Warren T. Vaughn (J.A.M.A., Feb. 21, 1925). The patient, a man, in 1917 developed a right parotid abscess following appendectomy and gastroenterostomy. When seen, in 1922, he complained of an unpleasant sensitiveness of the teeth on the left side. For two years, this side of the mouth had a feeling of dryness and an acid taste. The left side of the face perspired freely when food was masticated. Examination disclosed that both the upper and the lower teeth on the left side were worn half way down to the gums, having flattened, polished articular surfaces on which a cross-section of the gross anatomy of the teeth could be readily traced. The condition was most pronounced over the molar teeth. The articular surfaces were distinctly tender. The teeth on the right side were normal. An effort was made to collect saliva from the two parotid glands, but none could be obtained on the right, not even the administration of 6 mg. of pilocarpin producing the slightest flow. On the left, the sublingual and submaxillary glands apparently functioned normally. Mixed saliva was found normal and that from the right parotid was alkaline. Litmus paper showed the gums on both sides to be acid in reaction, as was the upper portion of the tongue. The mucous membrane below the tongue and the saliva from the floor of the mouth were alkaline. The erosion of the teeth was due apparently to failure of the atrophied left parotid to neutralize the acid secretion of the gums.

**Improved Anesthesia in Dental Surgery:** After an experience with 14,300 nitrous oxid-oxygen anesthesias in which synergistic methods were employed and cyanosis jactitation, holding straps and all elements of uncertainty were thus definitely eliminated, Morris Ecker (J.A.M.A., Feb. 28, 1925) determined, with the introduction of ethylene in 1923, to try out a number of cases with this agent for purposes of comparison. Animal experimentation was conducted for nearly a year, and in clinical work the method has been in use since one month before the end of the experimental period, as the tests demonstrated that ethylene was superior. In work with patients varying in age from 3 to 79 years, it was found that the patient was relaxed in surgical anesthesia when all the signs would indicate only the first stratum of the third stage of anesthesia, the patient being thus separated from the danger zone by the second and third strata. Analgesia is also more complete in proportion to the corresponding phase and stage. Ethylene lowers blood pressure and slows the heart, while nitrous oxid raises the blood pressure and quickens the pulse. Theoretically, in order to maintain the physiologic balance, the two gases should be used together or alternately as indicated. However, the best results were obtained when they are used in sequence and combination, the respiration, pulse, color and blood pressure being more nearly normal. The patient is first given nitrous oxid, 9 parts, to oxygen, 1 part, until unconscious. Ethylene is then gradually turned on until 4 parts is given. Oxygen is increased and nitrous oxid decreased to 2 parts each. From this point, the three gases flow continuously. Surgical anesthesia takes place in one and one-half to two minutes. Nausea occurs more frequently with the triple combination, but the patient is safer.

**Nitrous Oxid-Oxygen Anesthesia:** Nitrous oxid and oxygen is the safest anesthetic. No sick person is so good an anesthetic risk as the same person would be if he were well, but if an anesthetic must be given to a sick person, nitrous oxid and oxygen is safer than any other general anesthetic. Dr. Heidbrink believes that with a good technic nitrous oxid can be administered to many persons for whom any other anesthetic might be unfavorable or contraindicated, such as tuberculosis patients, women in ad-

vanced pregnancy, nursing mothers and others. It is generally conceded that no disease is a barrier to the successful administration of nitrous oxid and oxygen. Nitrous oxid does not destroy either normal or diseased tissues, as has been shown by experiments upon tuberculous animals who have been subjected to 85 per cent nitrous oxid and 15 per cent oxygen for forty-eight hours. Nitrous oxid and oxygen places no such burden on the eliminating organs as do many other anesthetics. It enters the blood as nitrous oxid, produces its anesthetic effect as nitrous oxid, and is eliminated by the lungs as nitrous oxid, elimination being complete within a few minutes after administration is stopped. With a good technic, anesthesia is quickly and comfortably induced and may be maintained for almost any desired time, and the patient recovers promptly with a minimum of discomfort. The symptoms are pronounced and easily interpreted, so that dangerously deep stages of anesthesia may be avoided.—Dent. Digest, February, 1925.

**Rules for Eating:** One should form the habit of eating properly. The following short rules may be found helpful: When you sit down to your meal, be at peace with yourself and all who are with you. See that you have plenty of time and do not feel hurried. Eat hard foods, masticate them well, and get all the taste you can out of them. Do not soak your food in milk, nor lubricate it with saliva for that purpose. Food should be of the right temperature. We drink and eat many things that are too hot. The child will refuse food that is too hot, and, if he is forced to take it, it will hurt the delicate membranes and cause suffering. The evils of overeating become evident in adult life. Be moderate in your eating and stop when your appetite says, "Enough." Finish your meal with cleansing food, especially when you will not have an opportunity to brush your teeth at once. Eat no food except at regular meal times, but drink plenty of water, especially in summer.—Dental Digest, February, 1925.

**Influence of Refined Sugar:** Sugar and all other sweets furnish food for the bacteria which produce decay. The worst time to eat sweetmeats is between meals, and the abominable practice of some parents of giving their children candy as a bribe to induce them to go to sleep is a perfect method of inviting dental caries, according to Dr. Kurt Thoma. The greatest harm, however, is done by the sugar when it is taken up by the body and begins its attraction of mineral salts. Free sugar is not a natural food, and the idea that children, or adults, for that matter, crave sugar because it is needed by the body is not based on sound reasoning. Contrary to prevailing opinion, sugar is not a food necessary to the development or nourishment of the body. Under certain conditions, it forms an easily absorbed emergency food, which is valuable after exhaustive exercise, but in normal life all the sugar needed by the growing child or the adult is formed from starchy foods in the process of digestion. A so-called craving for sugar is, in fact, a desire to indulge in the pleasure of its flavor, which in time leads to the formation of a habit that is most difficult to break, especially in children. A child who has never been permitted to indulge in sweets will eat cereal without sugar with as hearty an appetite as the one who covers his plate of oatmeal with it. It should be repeated that free sugar is not a natural food. Nature does not supply any food in such concentrated form, but man manufactures it from sugar cane, sugar beets, or the sap of the sugar maple. Primitive man's only supply of sugar was honey, and honey is made by the bee for the bee. However, if one's children have already been brought up with the sugar habit, one can at least replace the refined sugar used in most candies and cooking with brown or unrefined sugar, maple syrup, honey, or sweet fruit, such as figs, dates and raisins.—Dent. Digest, February, 1925.

**Temperance in Food:** Temperance in quantities of food, for adults engaged in sedentary occupations is still one of the most important teachings in relation to health, and that is especially true among professional people. The technic and art of dentistry is more largely a mental and nervous strain than a physical one. A rich, heavy meal, followed by a comfortable chair, book and cigar, is often much more appealing than a dinner of simpler but equally appetizing food, and a brisk walk, or other type of exercise, especially when one has been standing at a chair all day. Unfortunately, the use of motor cars complicates the situation too. High blood pressure, defects of posture and of the feet are often directly associated with excessive weight. Nephritis and diabetes, increasingly common diseases of middle age, also have a very direct relationship to incorrect diets and overweight. Joslin, the diabetes specialist, says it is largely in our own

hands whether we have this disease or not. He tells us that diabetes is ten times as rare among persons underweight as among the overweights; that at 40 years of age fat people are twenty times as liable and at 50 years forty times as liable to this disease as their thinner brethren. So one of the first safeguards in diet and health for the dentist is the question of excessive quantities of food for the age, degree of activity and general health of the individual. It is just as harmful to take a heavy meal when one is excessively fatigued or nervously overwrought as to eat in excess of his needs generally, be he fat or thin. It therefore follows that, with professional people, and especially the dentist, the quantity of food often must be limited, not only according to present weight and age, but to conditions of physical or nervous fatigue as well. It is not necessary to speak of calories; one's weight is a sufficient index as to the correct quantities to eat. To be slightly underweight for height and age after 30 is highly desirable.—Anna L. DePlanter, in Dent. Items Int., January, 1925.

**The Best Exercise:** Exercise which can be taken in the shape of play is par excellence the best, and I would never ask a man to go into a gymnasium and take the routine of a calisthenic drill, if I could get him out into the open to play tennis, or do anything which he would enjoy doing and produce the proper results. Unfortuately, in our great cities, and in the country at large, men have not learned to play. One of the saddest things I have to face every day, with our business men, is their inability to play. They have never learned how, or if they have learned, they have forgotten. A sad state of affairs, and I pity them from the bottom of my heart. Any man who has not learned to throw his whole soul into a game of tennis, or handball, or baseball, or some other exercise, where he can free himself of all care, and exercise his body to the full, has certainly lost a great deal out of life. Just here I want to throw out a word of warning. Competition in tennis, handball or any other game, which is not indulged in as play, cannot be of the most benefit. I see business men every day in the gymnasium, playing handball—and when they come off the court, they are in a worse state than when they went on, because they have made the winning of the game the big thing and the playing of the game the small thing, when the playing of the game, and the enjoyment and the social element, ought to have been the big thing, and the winning of the game of minor importance. I do not mean that a man should not try to win, but losing should not spoil the enjoyment of the game. Play is just an expression of physical life, and when you play, play and do not work at play.—George F. Poole, in Dent. Items Int., January, 1925.

**Dietetic Factor in Dental Caries:** Certain conclusions can be drawn from the results of recent investigations, which may be helpful: 1. The immediate cause of the carious process is due in the first instance to the solution of the enamel of the tooth by concentrated lactic acid, caused by the action of what is probably a specific group of bacilli, on carbohydrate material. 2. The incidence of the disease in modern times has been accelerated by the inclusion in the diet of highly fermentable free sugar combined with the sticky and adhesive nature of highly refined and cooked starches. 3. The over-use of fermentable and sticky sugars in unbalanced diets decrease the amount of saliva and increase its viscosity, thus preventing this fluid from performing its proper function. 4. Both macroscopical and microscopical hypoplasia, although perhaps not predisposing causes in the strict sense of the word, are at least contributory causes in that they decrease the resistance of calcified tissue and increase the rapidity of the disease. 5. Unbalanced and defective diets, which are chiefly lacking in vitamin A and calcium, may be responsible for defects in the structure and irregularity in the position of the teeth, while the bone of the jaws and the alveolar process are also defective. 6. The dietetic factor from the nutritional point of view seems the logical and natural avenue through which primary resistance to caries may be obtained and, to be effective, preventive measures should be commenced in the prenatal period, when the jaws and teeth are in the formative stages.—J. Mudie Petrie, in Dent. Rec., Jan. 1, 1925.

**Distortion of the Maxillary Arch:** In this case, described by W. W. James (Dent. Rec., Jan. 1, 1925), pressure was due to a sarcoma, involving the right cheek of a child, aged 6 years. Attachment was to the mandible, the maxilla not being involved. On the left side, the first permanent molar was in position in the mandible and was just showing in the maxilla. On the right, a roentgenogram showed that the mandible was in

an extraordinarily low position, while one of the cusps could be seen just near the floor of the mouth. Rarefaction of the mandible in the ascending ramus and at the base of the coronoid process was also visible. The maxillary arch was flattened from behind the cuspid and involved the bone almost to the vault of the palate. A similar deformity occurred also in the mandible, but, as the growth involved the bone, the change had perhaps less significance. The glands in the neck were removed, but they did not show any signs of growth. Radium was inserted and the tumor almost disappeared. It recurred and radium was again used. The case was lost sight of one year ago, at which time the growth was the size it was when first seen. The case was regarded as almost certainly fatal.

**Congenital Absence of Teeth:** A. T. Pitts (Dent. Rec., Jan. 1, 1925), reports congenital absence of the deciduous and permanent lower central incisors in four members of one family. Roentgenograms were taken in three cases, the mother reporting a similar condition in a child now dead. The other teeth were normal, the children were normal and healthy, and there was no history of a similar condition on either side of the family.

**Vitamins and Teeth and Bones:** By a process of a priori reasoning many dentists and pediatricians have reached the conclusion that the modern diet, rich as it is in refined foods, such as sugar, highly purified cereals, skinless fruits and vegetables, is the chief contributing factor to the abnormal conditions known as deficiency diseases. And, as a remedy, they propose a return to the use of the so-called natural foods, the whole grains, unrefined sugars and coarse textured vegetables. It is evident, however, as we must conclude after studying the latest scientific works on the subject, that the calcium content of food is not the all important factor in normal bone or tooth formation. The report (compiled by a committee appointed jointly by the Lister Institute and Medical Research Council, 1924) quotes at length the classic work of M. Mellanby, referring to her early studies in 1918, and to later investigations made in 1920, 1921, and 1923. . . . In brief, the results noted were: 1. Diminishing the calcium in the food as well as the fat-soluble vitamins produced very badly formed teeth. 2. Diminishing the calcium while the fat-soluble vitamins were kept high reduced calcification but produced well formed dentin. 3. Diminishing the fat-soluble vitamins and increasing the calcium in the food produced badly formed teeth. 4. Diminishing the fat-soluble vitamins and increasing the cereal intake gave worse formed jaws and teeth. Different cereals gave different results. Oatmeal was the worst cereal examined, while white flour and rice were the best. The addition of 20 per cent of wheat germ to white flour seriously injured tooth formation when the fat-soluble vitamins were deficient. When oatmeal was the cereal component of a diet deficient in fat-soluble vitamins the teeth were extraordinarily bad. On the other hand, fat-soluble vitamins fed in sufficient amounts neutralize the harmful effects of oatmeal just as they overcome to a larger extent a deficiency of calcium in the diet. The logical conclusion to be reached from a study of this work is: 1. That calcium rich foods do not in themselves contain the qualities necessary for proper bone and tooth formation but that an adequate amount of fat-soluble vitamins is essential to proper metabolism. 2. That foods heretofore thought to be deficient in lime content, such as white flour, rice, etc., will when fed with an adequate amount of fat-soluble vitamins produce normal bone and tooth structure. 3. That heretofore highly recommended foods, such as oatmeal and wheat germ, if used in a diet deficient in fat-soluble vitamins, produce very bady teeth.—Baking Technology, Jan. 15, 1925.

**Eradication of Goiter:** The importance of maintaining the proper functional activity of a gland as vital to our physical well-being as is the thyroid cannot be overestimated. The ease with which that may be done makes its neglect inexcusable. The time has not arrived when goiter must be eradicated. Our knowledge of the cause of the disease, its prevention and cure has reached the stage where we can proceed with confidence to that end. Those responsible to the public for the state of the public health, those interested in the betterment of public health are now in a position where, with cooperation, through moderate educational propaganda, they can persuade the public to take for itself the simple step which will insure an adequate iodine supply in the diet to prevent the development of goiter, to arrest the course of the disease where developed, and in the majority of cases to effect cures. By concerted action within a brief period this dread disease may be eradicated—and further honors

thus be made to accrue to those who are devoting their lives to disease eradication through preventive medicine.—J. W. Turrentine, in Scientific Monthly, January, 1925.

**Rickets and Irregular and Carious Teeth:** Under "The Progress of Nutrition," Francis Lowell Burnett (Boston M. & S. J., Jan. 15, 1925) discusses various factors in nutrition, especially as they bear on different pathologic conditions. Under rickets and irregular and carious teeth, he states that while the experimental production of rickets has led to many important observations, of the greatest importance is the fact that much has been found out as to the prevention and the relief of the condition. Quoting Howland, he says "Rickets has had its day." Although the disease is due to a lack of calcium in the bones, it is chiefly a diminished amount of phosphorus in the serum that is responsible for a failure of calcification, and this in turn is evidently due to defective absorption. Experimenters have determined that the beneficial action of sunlight and ultraviolet radiation is due to their increasing the amount of calcium and phosphorus absorption. Young animals, however, were found to be able to live on an adequate diet in darkness without rickets developing or their rate of growth being reduced. As regards the teeth, Burnett says: "Anatomically, the teeth form part of the bony framework, and the eruption and composition are influenced by factors that affect the skeleton. Such a fact is strikingly apparent with a rachitic and scorbutic diet. Normally, the dental ridges of the maxillae are broad and allow sufficient room for the teeth to erupt in perfect alignment; but under the influence of an inadequate diet the ridges are considerably narrowed and the teeth erupt irregularly. Howe and others have produced irregular and carious teeth by feeding animals on deficient diets. And Toverud has found by a chemical analysis of these defective teeth that the calcium is partly replaced by magnesium. Such teeth are evidently much less resistant to the agents that produce caries."

**Focal Infection:** It is immaterial whether we all believe the same things or not, but we should all be searchers after the truth, and it should be our rule to assume responsibility for the patient's health to the fullest extent when the patients put themselves in our hands. If conditions are such in the mouth that they may have a bearing on the general health symptoms which the patient is suffering from, get in touch with the patient's physician and specialist. Study this question earnestly and diligently and know where you stand and make recommendations. Do not belong to the class which takes the position that the patient's teeth are detached from the rest of the body, that anything can be done to them that is possible mechanically without danger to the general system. Or still worse, do not belong to the class that assumes the attitude when your patient is sent back to you by his family physician with the request from the physician for a careful examination, because of a suspected focus or foci in the mouth, and you look this patient over in a perfunctory way, and stand back on your heels and throw out your chest and say, "Of course, your mouth is all right; I have been taking care of you the best that is possible for twenty years." Make out a program of prophylaxis for your younger patients now, and teach it to them. Also talk to them about the right foods to eat, and fortify this on-coming generation against the bodily ills that have been caused by infected teeth during the last generation.—Raymond Grant, in Dent. Summary, February, 1925.

**Dental Infection and Related Degenerative Diseases:** W. A. Price (J.A.M.A., Jan. 24, 1925) discusses some structural and biochemical factors, summarizing data developed in researches on the relation of focal infection to systemic disease, with particular consideration of dental focal infection and the degenerative diseases, and especial reference to structural changes that take place in the supporting structures about dental focal infection, and to serologic changes in body serums. In a résumé, he says: "When a person has a normally high defense, as expressed by absence of recurring rheumatic group lesions, he or she tends to make the warfare against the organisms and toxic materials coming from the openings at the apexes of the involved teeth as close to the source of that infection as possible. This seems to be a principal reason why these patients have the large zones of rarefaction. This large zone of radiolucence is generally occupied in these individuals by a highly vascularized, defensive tissue, whose function appears to be chiefly that of a local quarantine station. When it is adequate and efficient, the balance of the body is protected. The production of the local warfare expresses itself as pus, which is eliminated usually through a

fistula and contains exceedingly few, and often no, living organisms. It is apparently largely because these individuals can make a fight to a finish close by the source that the balance of the body is safe from injury from these disturbances. When, however, that patient with a normally high defense has an overload, such as influenza, pregnancy, grief, exposure or poor nutrition, there is inability to continue the maintenance of the adequate quarantine, the warfare is no longer a fight to a finish immediately about the tooth, and the organisms and their toxic products pass into the body; and that warfare, which should have been made in special tissues close to the source of the infection, must now be made in the various organs and tissues of the body."

**Malocclusion and the Deciduous Dentition:** This subject is treated by Harold Chapman (Dent. Magazine, January, 1925) under three heads: 1. Malocclusion is common in the deciduous dentition. 2. Many malocclusions, not of local origin, are initiated, and often in being, not later than at two or three years of age. 3. The premature loss of deciduous teeth has a baneful effect on occlusion, which of necessity must be obviated.

**The White Bread Question:** We would draw attention to the report of Sir Harry Baldwin's outspoken pronouncement on the merits and demerits of bread made from wholemeal and from white flour respectively. Backed by the weight of authority which the speaker's name commands, it is to be hoped that his words may have some effect in shaking the very stupid but very deepseated preference which, in all ranks of society, appears to prevail in favour of white bread as compared with bread that is really nutritious. A delusion and a snare, white bread is comparatively harmless where its deficiencies are compensated by other foods; but where, as is unhappily the case among the working classes, it constitutes the principal "staff" on which life is supposed to depend—then it must be looked upon as nothing less than a menace to the national health—no staff, but veritably a broken reed.—Brit. Dent. J., Jan. 15, 1925.

**Caries Dentis:** In a rather extensive piece of work, the author (Guttorm Toverud, in Den norske tandlaegefor tid., 1923-1924) has raised the question whether or not the diet has any influence on the development of carious teeth. He finds from histologic studies of guinea-pig teeth, where the animals have been on a scorbutic diet, a marked change in the pulp and the dentin. Chemical studies of analogous teeth show a diminution in the calcium and ash, and an increase in magnesium. He has also studied the influence of a calcium poor diet on the teeth and bones of white rats. He has found a decrease in ash, calcium, phosphorus and magnesium in the front teeth (constantly growing). In the molar teeth (outgrown when started on the diet) he found a decrease in total ash, calcium and phosphorus, but an increase in magnesium. In the bones, the changes were just the same as in the molar teeth. Metabolism studies on these rats showed a lower calcium retention and a higher magnesium retention than in control rats on a normal calcium ratio. Blood calcium averaged 6.5 mg. per hundred cubic centimeters. The author finally emphasizes the value of the diet, as such, on the development and maintenance of good teeth. In the diet, he especially lays stress on the content of calcium and vitamins.—Abstr. Am. J. Dis. Child., January, 1925.

**Prevention of Crime:** The greatest need at the present time is for research into the nature and causes of delinquency. This is strictly a medical problem, though it will also reach largely into the fields of psychology, sociology, biology and allied sciences. Many agencies engaged in such efforts already exist, but for the most part they are poorly supported and meagerly equipped. There is urgent need for closer cooperation and coordination if facts are to be established, and speculative hypotheses, which can lead to nothing but distrust and delay in the adoption of a rational procedure, are to be avoided. The figures quoted (total cost of crime, $10,000,000,000; direct loss, $3,000,000,000), even with a large allowance for overzealous computation, are surely large enough to justify the expenditure of even large sums for research into methods of prevention. As a strictly business proposition, such a proposal should receive the heartiest endorsement and support from official as well as from voluntary agencies of society.—J.A.M.A., Jan. 3, 1925.

# Announcements

## CALENDAR OF MEETINGS

### NATIONAL SOCIETIES

American Academy of Periodontology. Louisville, Kentucky, September 17-19, 1925.

American Dental Assistants' Association. September 21-25, 1925, Louisville, Kentucky.

American Dental Association, September 21-25, 1925, Louisville, Kentucky.

American Dental Society of Europe, July 28-31, London.

American Medical Association. May 25-29, 1925, Atlantic City, New Jersey.

American Society of Orthodontists, April 14-17, 1925, Atlanta, Georgia.

Fédération Dentaire Internationale. August 2-6, 1925, Geneva, Switzerland.

Pacific Coast Dental Conference, 1926. Portland, Oregon.

Philadephia Dental College Alumni, April 15, 1925, Philadelphia, Pennsylvania.

Seventh International Dental Congress, August 23-27, 1926, Philadelphia, Pennsylvania.

Southwestern Society of Orthodontists, April 8-11, 1925, Tulsa, Oklahoma.

### STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

National Capital at Washington, D. C., first Tuesday of every month.

April (1925)

Alabama, at Mobile (6-8).
Alumni Assoc. of College of Physicians and Surgeons of San Francisco (23).
Connecticut, at Hartford (April 30-May 2).
Kansas, at Hutchinson (20-22).
Michigan, at Grand Rapids (13-15).
New Jersey, at Newark (8-11).
Oklahoma, at Oklahoma City (April 27-May 1).
Virginia, at Staunton (27-29).

May (1925)

California, at Oakland (25-28).
Illinois, at Peoria (12-14).
Indiana, at Indianapolis (18-21).
Iowa, at Des Moines (5-7).
Maryland, at Baltimore (4-6).
Massachusetts, at Boston (4-8).
Mississippi, at Jackson (19-21).
Missouri, at Kansas City (11-13).
Nebraska, at Omaha (18-21).
New York, at Albany (13-15).
North Carolina, at Pinehurst (12-14).
North Dakota, at Fargo (5-7).
Pennsylvania, at Reading (5-7).
Tennessee, at Knoxville (5-7).
Texas, at San Antonio (19-22).
West Virginia, at Beckley (18-20).

June (1925)

Colorado, at Colorado Spring (18-20).
Georgia, at Augusta (10-12).
Maine, at Bangor (25-27).
New Hampshire, at Manchester (10-12).
New Mexico, at Albuquerque (20).
Oregon, at Portland (3-6).
South Carolina, at Columbia (17-19).
South Dakota, at Watertown (11-13).
Southern California, at Los Angeles (29-30, July 1-2).
Utah, at Salt Lake City.
Washington, at Spokane (1).

July (1925)

Rhode Island, at Newport.
Wisconsin, at Madison (14-16).

September (1925)

Kentucky, at Louisville (18-19).

October (1925)

Florida, at Orlando.

December (1925)

Nevada, at Reno (5).
Ohio, at Columbus (1-3).

February (1926)

Minnesota, at St. Paul (10-12).

## MEETINGS OF THE STATE BOARD OF DENTAL EXAMINERS

Alabama, at Tuscaloosa, commencing June 22, 1925, Secretary, E. W. Patton, Selma, Alabama.

Arkansas, at Little Rock, June 22-24, 1925. Secretary, W. E. Hutchison, Dermott, Arkansas.

California, at San Francisco, May 9, 1925 and at Los Angeles, June 13, 1925. Secretary, O. E. Jackson.

Connecticut, at Hartford, June 25-27, 1925. Recorder, Arthur B. Holmes, Waterbury, Connecticut.

District of Columbia, at Washington, June 22-26, 1925. Secretary, C. Willard Camalier, Washington, D. C.

Florida, at Jacksonville, June 24, 1925, Secretary, R. P. Taylor, 414 St. James Bldg., Jacksonville, Florida.

Indiana, at Indianapolis, June 8-13, 1925, Secretary, H. C. McKittrick, 502 I.O.O.F. Bldg., Indianapolis, Indiana.

Iowa, at Iowa City, June 1, 1925. Director, H. W. Grefe, Des Moines, Iowa.

Kansas at Wichita, June 15, 1925. Secretary, George E. Burket, Kingman, Kansas.

Kentucky, at Louisville, June 2, 1925. Secretary, J. H. Baldwin, 908 Francis Building, Louisville, Kentucky.

Maine, at Augusta, June 29-July 1. Secretary, G. W. MacKay, Millinocket, Maine.

Nevada, at Reno, May 13, 1925. Secretary, G. H. Marven, P. O. Box 56, Reno, Nevada.

New Jersey, at Trenton, June 29-July 3, 1925, Secretary, John C. Forsyth, 429 E. State St., Trenton, New Jersey.

North Dakota, July 14, 1925, Secretary, W. E. Hocking, Devils Lake, North Dakota.

Oklahoma, at Oklahoma City, June 22, 1925. Secretary, L. M. Doss, American National Bank Building, Oklahoma City, Oklahoma.

Pennsylvania, at Philadelphia and Pittsburgh, June 17-20, 1925. Secretary, Alexander H. Reynolds, 4630 Chester Avenue, Philadelphia, Pennsylvania.

South Dakota, at Sioux Falls, June 17-19, 1925. Secretary, G. G. Kimball, Mitchell, South Dakota.

Texas, Dallas, June 8-11, 1925. Secretary, R. L. Rogers, Amarillo, Texas.

## NEVADA STATE DENTAL ASSOCIATION

The Nevada State Dental Association will hold its next annual meeting, Dec. 5, 1925, at Reno.

GEORGE A. CARR, *Secretary,*
Reno, Nev.

## FLORIDA STATE DENTAL SOCIETY

The Florida State Dental Society will hold its annual meeting in October, at Orlando.

H. G. BOW, *Secretary,*
DeLand, Fla.

## GEORGIA STATE DENTAL SOCIETY

The next meeting of the Georgia State Dental Society will be held in Augusta, June 10-12, 1925. G. A. MITCHELL, *Secretary,*
Candler Bldg., Atlanta, Ga.

## MAINE DENTAL SOCIETY

The sixtieth anniversary meeting of the Maine Dental Society will be held at Bangor, Maine in the City Hall, June 25, 26, 27, 1925.

W. F. FOGG, *Secretary,*
Waterville, Maine.

## MICHIGAN STATE DENTAL SOCIETY, GRAND RAPIDS, APRIL 13-15, 1925

PROGRAM

Address, by George E. Vincent, New York City, the president of the Rockefeller Foundation.

"Diet and Health," by Percy R. Howe, Boston, Mass.

"Full Dentures," by Russell W. Tench, New York City, lecture and clinic.

"Metal Bases," by John B. LaDue, Chicago, Ill., lecture and clinic.

"X-Ray Technique and Interpretation," by C. O. Simpson, St. Louis, Mo. Lecture illustrated with slides.

"Crown and Bridge," by Drs. M. H. Mortonson and J. C. Mortonson, Milwaukee, Wis. Lecture and clinic.

## MINNESOTA STATE DENTAL ASSOCIATION

The next meeting of the Minnesota State Dental Association will be held, Feb. 10-12, 1926, at St. Paul.

R. G. KEYWORTH, *Secretary,*
1048 Lowry Bldg., St. Paul, Minn.

## NEBRASKA STATE DENTAL SOCIETY

The fifty-eighth annual meeting of the Nebraska State Dental Society will be held May 18, 19, 20 and 21, 1925, at Omaha. Drs. Weston A. Price, L. I. Furnas and A. L. Walters will be the visiting essayists and all members of the American Dental Association are cordially invited.

H. E. KING, *Secretary,*
546 Peters Trust Bldg.,
Omaha, Nebr.

## DENTAL SOCIETY OF THE STATE OF NEW YORK

PRELIMINARY PROGRAM

The fifty-seventh annual meeting of the Dental Society of the State of New York will be held at the Ten Eyck Hotel, Albany, N. Y., May 13-15, 1925.

A cordial invitation is extended to all ethical practitioners. Admission to the literary meetings and clinics may be secured by presenting membership cards in state or national societies.

The literary exercises and exhibits will be held at the Ten Eyck Hotel. Dr. E. W. Briggs, 1116 Madison Avenue, Albany, N. Y., is chairman of the Exhibits Committee, and those desiring space should communicate with him immediately.

Hotel reservations should be made direct with the hotel management; headquarters, Hotel Ten Eyck.

The Executive Council will convene for the transaction of the business of the society, Tuesday, May 12, at 3:00 p. m.

The program is as follows:

*Wednesday, May 13*

9:30 a. m. Call to Order.

Invocation by Rev. Roelif H. Brooks.

10:00 a. m. Address of Welcome on Behalf of the Third District Society, A. S. Downing.

Response for State Society, R. Ottolengui.

10:30 a. m. President's Address, J. W. Canaday.

11:00 a. m. Report of Dental Research Committee.

1:00 p. m. Fraternity Luncheons.

2:30 p. m. "Prosthetic Dentistry", M. M. House, Kansas City, Mo.

4:00 p.m. Report of Oral Hygiene Committee.

Report of Oral Hygiene Activities in the State.

6:30 p. m. Fathers and Sons Dinner.

8:15 p. m. Illustrated Paper, Arthur J. Bedell (M.D.)

9:30 p. m. "Prevention of Oral Diseases by Correction of Dietary Errors," Clarence J. Grieves.

*Thursday, May 14*

9:00 a. m. to 12:00 M. Clinics.

2:00 p. m. "Preventive Dentistry", Martin Dewey

3:30 p. m. "Simplifying the Development of Esthetics and Occusion", Walter Chappelle.

4:30 p. m. Report of the President of the Board of Examiners.

5:30 p. m. Reception of Past Presidents, Recipients of the Jarvie Medal, and the Board of Dental Examiners.

6:30 p. m. Oral Health Dinner.

8:00 p. m. Awarding of Jarvie Fellowship Medal.

Address by Woods Hutchinson.

Address by Percy R. Howe.

Consideration of Proposition to Inaugurate State-Wide Oral Health Policy.

*Friday, May 15*

9:00 a. m. to 12:00 M. Clinics.

2:00 p. m. "Some Phases of Operative Dentistry", C. N. Johnson.

3:30 p. m. "The Gold Inlay, with Reference to Revised Cavity Preparation", John J. Travis.

Awarding of Past President's Badge and Inauguration of New President.

Final Adjournment.

During the time of the meeting of the New York State Dental Society, sessions of the New York State Dental Hygienists' Association and the Dental Assistants' Association will be held.

Every effort is being put forth to make this meeting one of the most attractive in the history of the society.

For further information and programs address.

A. P. BURKHART, *Secretary*,
57 E. Genesee Street.
Auburn, N. Y.

## NEW HAMPSHIRE DENTAL SOCIETY

The New Hampshire Dental Society will meet at the Hotel Carpenter, Manchester, June 10-12, 1925.

W. J. MOYLES, *Secretary*,
Manchester, N. H.

## OHIO STATE DENTAL SOCIETY

The Ohio State Dental Society will meet at Columbus, Dec. 1-3, 1925.

E. C. MILLS, *Secretary*,
255 East Broad St.,
Columbus, Ohio.

## OKLAHOMA STATE DENTAL SOCIETY

The Oklahoma State Dental Society will meet, April 27-May 1, 1925, at Oklahoma City.

A. B. WALKER, *Secretary*,
Norman, Okla.

## OREGON STATE DENTAL ASSOCIATION

The Oregon State Dental Association will hold its annual meeting at Portland, June 3-6, 1925.

F. W. HOLLISTER, *Secretary*.
611 Morgan Bldg.,
Portland, Ore.

## SOUTH CAROLINA STATE DENTAL ASSOCIATION

The South Carolina State Dental Association will hold its fifty-fifth annual meeting, June 17-19, 1925, in Columbia, at the Jefferson Hotel.

ERNEST C. DYE, *Secretary*,
Greenville, S. Car.

## SOUTH DAKOTA STATE DENTAL SOCIETY

The South Dakota State Dental Society will hold its annual meeting at Watertown, June 11-13, 1925.

C. K. WALKER, *Secretary*,
Huron, S. Dak.

## LONG BEACH DENTAL SOCIETY FIELD DAY AND CLINICS

The second annual field day and clinics will be given by the Long Beach Dental Society, April 22 and 23, 1925, at Long Beach, California.

On Wednesday, April 22, a meeting will be held devoted to children's health, from the standpoint of preventive dentistry and diet, as shown with our public school work. This meeting will be public. Guy S. Millberry, San Francisco, Dean of the University of California, will be the speaker of the evening. This will be broadcasted over K.F.O.N.

Thursday, April 23, will be devoted to good fellowship and dentistry, beginning with golf at 8 a. m. and a golf luncheon at 12:30 o'clock at the Virginia Country Club. Clinics will be held at the Chamber of Commerce Auditorium from 1:30 to 5:00 covering every phase of dentistry.

An unusual dental and golf dinner will be held at the Virginia Hotel at 6:00 o'clock at which time the governor, mayor, council, board of education, club leaders and educators will be guests of honor.

## DENTAL CONVENTION AT WINNIPEG

American dentists are cordially invited to attend the Dental convention at Winnipeg, Manitoba, May 12-15, 1925. Clinics will be given by study clubs of the Western Provinces; also by Dr. H. A. Maves of Minneapolis. Dr. Weston A. Price of Cleveland will give three lectures and a moving picture talk relating to researches on focal infection.

E. ROY BIER,
545 Somerset Block,
Winnipeg, Canada.

## ALABAMA BOARD OF DENTAL EXAMINERS

The Board of Dental Examiners of Alabama will hold its next annual meeting in Tuscaloosa, Alabama, commencing June 22, 1925, for the purpose of examining applicants to practice Dentistry and Hygiene in Alabama. It is of utmost importance that applicants confer with this office for information relative to examination early since signed application, photo, and other credentials must be in the hands of the Secretary-Treasurer at least two weeks before examination.

E. W. PATTON, *Secretary-Treasurer*,
Selma, Ala.

## ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Arkansas State Board of Dental Examiners will be held at Little Rock, June 22-24, 1925.

W. E. HUTCHISON, *Secretary*,
Dermott, Ark.

## CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet in Hartford, June 25-27, to examine applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before them. For further information, apply to

ARTHUR B. HOLMES, *Recorder*,
Waterbury, Conn.

## DISTRICT OF COLUMBIA BOARD OF DENTAL EXAMINERS

The next examination of the board of dental examiners of the District of Columbia will be held, June 22-26 at Washington.

C. WILLARD CAMALIER, *Sec'y-Treas.*,
Medical Science Building,
Washington, D. C.

## FLORIDA STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the Florida State Board of Dental Examiners will be held in Jacksonville, Florida, June 24, 1925. Application blanks and all information may be obtained from R. P. Taylor, Secretary, 414 St. James Building, Jacksonville, Florida.

R. P. TAYLOR, *Secretary*,
Jacksonville, Fla.

## KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the Kentucky State Board of Dental Examiners will be held, June 2, 1925, at Louisville. Graduates of schools classified as A and B by the Dental Educational Council are eligible for examination. For blanks and detailed information, apply to

J. H. BALDWIN, *Secretary*,
908 Francis Bldg., Louisville, Ky.

## NEVADA STATE BOARD OF DENTAL EXAMINERS

Nevada State Board of Dental Examiners will hold its next examination at Reno, beginning Wednesday, May 13, 1925.

G. H. MARVEN, *Secretary*,
P. O. Box, 56, Reno, Nev.

## NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the North Dakota State Board of Dental Examiners will be held the second Tuesday in July.

W. E. HOCKING, *Secretary*,
Devils Lake, N. D.

## OKLAHOMA STATE BOARD OF DENTAL EXAMINERS

The Oklahoma State Board of Dental Examiners will meet at the State Capitol Bldg., Oklahoma City, beginning June 22.

L. M. DOSS, *Secretary*,
American National Bank Bldg.,
Oklahoma City, Okla.

## PENNSYLVANIA BOARD OF DENTAL EXAMINERS

The next meeting of the Pennsylvania Board of Dental Examiners will be held in Philadelphia and Pittsburgh, June 17-20, 1925. The theoretical examinations will be held at the Musical Fund Hall, 808 Locust Street, Philadelphia and the University of Pittsburgh, Pittsburgh. The practical examinations will be held at the Evans Dental Institute, Philadelphia, and the University of Pittsburgh, Pittsburgh, June 17, at 8:30 a. m. Examinations will also be held at the same time and places for dental hygienists. Examinations will be held for students who have completed their second year at the same places, June 18-19. Application papers may be secured from the Department of Public Instruction, Harrisburg.

For further information, address

ALEXANDER H. REYNOLDS, *Secretary*,
4630 Chester Avenue,
Philadelphia, Pa.

## SOUTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the South Dakota State Board of Dental Examiners will be held in Sioux Falls, June 17-19, 1925, beginning promptly at 1:00 p. m., Wednesday, June 17. All applications must be in the hands of the secretary by June 2. The fee for the examination is $25. There is no reciprocity or interchange. Full information and application blanks may be had by addressing

G. G. KIMBALL, *Secretary*,
Mitchell, S. Dak.

## EXAMINATION FOR ARMY DENTAL CORPS

A preliminary examination of candidates for appointment and commission in the Dental Corps of the Regular Army will be held during the week commencing Monday, April 27, 1925. At present, there are five vacancies in the corps. The Surgeon General asks that all means be used for disseminating this information for the benefit of prospective candidates.

The law governing appointments in the Dental Corps requires that a candidate, to be eligible, must be a citizen of the United States between the ages of 23 and 32 years, a graduate of a recognized dental college, must have been engaged in the practice of his profession for at least two years subsequent to the date of his graduation and must hold a commission in the Dental Reserve Corps. Graduates of the June, 1923 classes of recognized dental colleges are being authorized to undergo the preliminary examination to be held April 27, provided they meet the other requirements.

Army regulations require that a candidate undergo a preliminary and a final examination. Should he be successful in the preliminary examination, which covers professional subjects, he is granted a commission in the Dental Reserve Corps, if he does not already hold such commission. It is, therefore, not necessary that a candidate hold commission in the

Dental Reserve Corps when applying for examination. All candidates who successfully undergo the preliminary examination are ordered to active duty at the Medical Field Service School, Carlisle Barracks, Pennsylvania, or to the Army Dental School, Army Medical Center, Washington, D. C., for observation and instruction for a period of approximately four months, on completion of which they are required to undergo final examination. At the time of this preliminary examination, a candidate must be not less than 22½ and not more than 31½ years of age; this to insure that he will be between the ages of 23 and 32 years at the time of the appointment in the Dental Corps, Regular Army, as required by law. This will afford sufficient time to complete the preliminary examination, notify the candidate of results and give him ample time to settle his business affairs before entering active duty and to complete the four months' observation and training as a Reserve officer. All successful candidates in the final examination are commissioned as first lieutenants in the Dental Corps, Regular Army.

Blank forms for making application for this examination can be obtained from the Surgeon General of the Army, Washington, D. C. Approved applicants will be informed in ample time as to the exact place of the nearest examination board.

No allowances can be made for the expenses of applicants undergoing preliminary examination, whether incurred in travel to and from, or during their stay at the place of, the examination. Public funds are not available for the payment of such expenses.

## ALUMNI ASSOCIATION, COLLEGE OF PHYSICIANS AND SURGEONS OF SAN FRANCISCO

The Annual Meeting of the Dental Alumni Association of the College of Physicians and Surgeons of San Francisco, a School of Dentistry, will be held, Saturday, May 23, 1925. Clinics will be given at the College during the day. Programs will be mailed prior to the meeting.

ERNEST G. SLOMAN,
*Chairman Publicity Committee,*
344 Fourteenth Street,
San Francisco, Calif.

## COURSE IN DIETETICS POSTPONED

The special course (University Extension) in dietetics for dentists scheduled for February 17, at the University of Washington, Seattle, has been postponed for two months.

W. E. LOWRIE,
Puget Sound National Bank Bldg.,
Tacoma, Wash.

## AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The American Dental Hygienists' Association is to meet at Louisville, Ky., during the week of September 21-25, in conjunction with the meeting of the American Dental Association. Following is a list of officers:

President, Mrs. Hubert W. Hart, 109 Rocton Ave., Bridgeport, Conn.; President Elect, Miss Edith C. Hardy, Professional Bldg., 35 Chestnut St., Rochester, N. Y.; Secretary, Miss Elma P. Platt, 910 30th St., Sacramento, Calif.; Treasurer, Mrs. Helen Hilbish Critz, 1336 Keith Bldg., Cleveland, Ohio; Vice Presidents, Miss Ethel Covington, 324 Metropolitan Bldg., Denver, Colo; Miss Emma Ditzell, 238 Wood St., Burlington, N. J.; Miss Evelyn C. Schmidt, 5 N. Wabash Ave., Chicago, Ill.

## DENTAL HYGIENISTS' ASSOCIATION OF THE STATE OF NEW YORK

The fifth annual meeting of the Dental Hygienists' Association of the State of New York will be held at the Hotel Ten Eyck, Albany, N. Y., May 14-16, 1925. A cordial invitation is extended to dentists and dental hygienists to attend the clinics and literary meetings.

The program is as follows:

*Thursday, May 14*

3:00 p. m. Executive meeting.

6:30 p. m. Oral Hygiene dinner, Roof Garden, Hotel Ten Eyck.

*Friday, May 15*

9:00-12:00 a. m. Clinics (Third floor).

2:00 p. m. Open Meeting (Parlor B).

"Diet and Health", by Percy R. Howe, Boston.

"Work of the Hygienist in the Bloomingdale Hospital for the Insane", by Helen Donehue, D.H.

"Dentifrices", by C. J. Brophy, New York City.

"Dental Hygiene Work in the Public Schools of Newark, N. J.", by Sadie Abrich, D.H.

Subject not announced, R. Ottolengui, New York City.

*Saturday, May 16*

9:00-10:30 a. m. Business meeting.

10:30 a. m. Open meeting. Speakers (Parlor B).

1:00 p. m. Informal luncheon.

HARRIETT PLUMSTEAD, *President,*
184 Joralemon St., Brooklyn.
HELEN R. DONEHUE, *Secretary,*
Bloomingdale Hospital, White Plains.

## MEETING OF THE AMERICAN ACADEMY OF PERIODONTOLOGY

The twelfth annual meeting of the American Academy of Periodontology will be held at the Brown Hotel, Louisville, Ky., September 17-19, 1925.

The Academy extends an invitation to all ethical dentists to attend these meetings.

ARTHUR H. MERRITT, *President*,
58 West 47th St., New York City.
J. HERBERT HOOD, *Secretary*,
624 Hanna Bldg., Cleveland, Ohio.

## RESOLUTIONS BEFORE THE CHICAGO DENTAL SOCIETY ON THE DEATH OF DR. J. W. BIRKLAND

WHEREAS: The late Dr. J. W. Birkland was taken from this life on November 7, 1924, after a three months' illness, and

WHEREAS: We loved him for his sterling qualities, modest and retiring disposition, his wonderful genius as a dentist and his devotion to his family and friends; be it therefore,

*Resolved*, That the Chicago Dental Society in session assembled express its appreciation of his many wonderful qualities, his unselfish devotion to the work of this society; and be it further

*Resolved*, That the Secretary of the Chicago Dental Society be instructed to spread these resolutions on the records of this Society and send a copy to dental journals and to the family of the late Dr. J. W. Birkland.

(Signed) JAMES H. PROTHERO, *Chairman*
FRANK G. CONKLIN,
HUGO G. FISHER.

## RESOLUTION PASSED BY PREVENTIVE DENTISTRY SECTION OF THE FIRST DISTRICT DENTAL SOCIETY OF NEW YORK

WHEREAS, The Section of Preventive Dentistry of the First District Dental Society, State of New York was organized for the purpose of studying problems concerning the prevention of dental disease and for the dissemination of knowledge pertaining to preventive dentistry, and

WHEREAS, A broad interpretation of preventive dentistry includes within its scope the early discovery and treatment of dental caries and other dental abnormalities, and

WHEREAS, Advanced dentistry recognizes the importance of preserving the deciduous teeth throughout the deciduous period, and recognizes and insists on the importance of the detection and filling of incipient caries in all teeth, and

WHEREAS, It is common practice of some dentists to refuse to fill carious cavities in deciduous teeth on the ground that "They are but temporary teeth and will be replaced by the permanent teeth" and to decline to fill small cavities in either deciduous or permanent teeth on the ground that "They are not large enough to fill", and

WHEREAS, Such practices are not in keeping with modern teaching and practice and are obstacles to the progress of individual and organized efforts toward obtaining the objectives of the preventive dentistry movement; therefore, be it

*Resolved*, By the Section of Preventive Dentistry of the First District Dental Society State of New York that habitual failure properly to remove carious matter and properly to fill cavities in deciduous teeth solely on the ground that such teeth are but "temporary and will later be replaced with permanent teeth" and that habitual failure properly to prepare and fill carious cavities in any teeth on the ground that such cavities are too small to fill, constitute a transgression of the accepted principles of advanced dental teaching and practice and are therefore detrimental to the health and well-being of the public, and be it

*Resolved*, That such practices are unreservedly condemned, and be it

*Resolved*, That nothing in these resolutions is intended to restrict the freedom of action of the dentist in individual cases where illness or other causes would prevent the application of these principles of routine practice, and be it

*Resolved*, That all dental societies, local, state and national, as well as other unaffiliated professional dental associations are asked to adopt similar resolutions.

## PATENTS OF INTEREST TO DENTISTS

1443394. Crown adapted, Richardson, H. Taylor, Meeker, Colo.

1444060. Dental flask, Martin F. Burns, Astoria, N. Y.

1444368. Individual sanitary toothbrush holder, Frederick T. Conley, Boston, Mass.

1444370. Combination mouth gag and tongue depressor, Joseph Duke, New York, N. Y.

1444077. Holder for X-ray plates, Fred W. Koehn, Marshfield, Wis.

1444708. Combination baking apparatus for dental molds, Elmer A. Schrader, Independence, Iowa.

1444436. Porcelain veneer crown and making same, Frank W. Teeter, La Grange, Ill.

Copies of above patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, Federal Building, Washington, D. C.

# The Best State in the Union

*By Ernest V. Madison*

THERE is a state, in the United States of America, that pays a subsidy to its citizenry.

Each citizen of this state is a good business man, is prepared to meet emergencies and new conditions and is free from hesitation and doubt when immediate decision is called for.

Perhaps you live in this *state of being ready.* If you do, then you know the pleasure of meeting Opportunity at the half-way house. You have proved to be a good buyer of the necessities for your business life. You are a regular reader of the advertisements in your periodicals. You have found that ideas are to be obtained there, and that ideas and facts are important requirements of citizenship in this super state.

If you are not a citizen of the *state of being ready* let us point out that the way toward becoming one lies before you.

The first important step is to form the educational habit of reading the advertisements in your business papers.

The advertising section in this issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION is at your service. Read through it. Your time will be spent not only profitably, but most enjoyably as well.